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[R002] Convenient of which strength stainless sieel sheets for structural materials of which correspondence resistance.

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Chiyoda-ku Tokyo 100-0011 (JP). • Furukimi, Osamu, Int. Prop. Dept. Chiyoda-ku Tokyo 100-0011 (JP) asciniats bilimet to dipolente en everament ehem.) Representative: **Grünecker, Kinkeldey,** Millor to noucoporture and travelle organismente. Stockmair & Schwanhäusser Anwaltssozietät

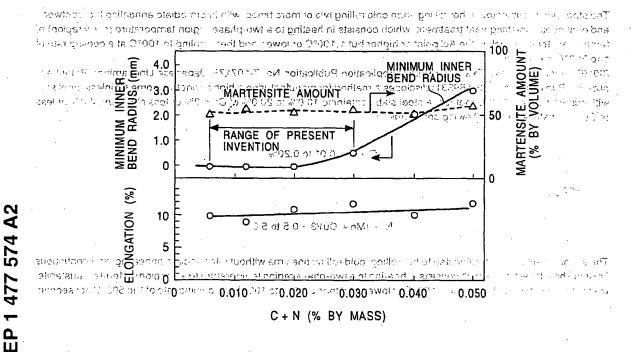
Maximilianstrasse 58 80538 München (DE)

(54) High-strength-stainless steel sheet and method for manufacturing the same a properties. mathems, and continued to Wolf to 14,00% to 16,00% of the continued of the continued on the

Material for stainless steel sheets is heated to a temperature within a range of 850 to 1250°C and cooled at a rate 1°C/s or faster, the material including 0.02% by mass or less of C, 1.0% by mass or less of Si, 2.0% by mass or less of Mn, 0.04% by mass or less of

P, 0.01% by mass or less of S, 0.1% by mass or less of Al, 11% by mass or more but less than 17% by mass of Cr, 0.5% by mass or more but, less than 3.0% by mass of Ni, and 0.02% by mass or less of N, so as to satisfy specific relationships between the compositions.

FIG. 1 ...



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BACKGROUND OF THE INVENTION

1. Field of Invention

国际基础

[0001] The present invention relates to a high-strength stainless steel sheet, and particularly relates to a high-strength stainless steel sheet for civil engineering and construction structural materials.

SUPPOPEAR PATENT APPLICATION

2. Description of Related Art

[0002] Conventionally, as high-strength stainless steel sheets for structural materials of which corrosion resistance is required, cold-rolled austernitic stainless steel sheets, or marteristic stainless steel sheets, which have been tempered and annealed, have been widely used.

[0003] However, austenitic stainless steel sheets have a low young's modulus, which is disadvantageous when it comes to ensuring rigidity in structural design. Also, austenitic stainless steel sheets may exhibit structural defects because of the strains introduced during cold rolling, and further, the costs of manufacturing austenitic stainless steel sheets are high because approximately 8% by mass of Ni, which is expensive, is used. Moreover, martensitic stainless steel sheets exhibit poor ductiliny, and markedly deteriorated workability.

[0004] On the other hand, ferritic stainless steel sheets have good ductility, but exhibit a low strength. Attempts have been made to improve the strength of ferritic stainless steel sheets by cold-rolling to increase strength, but this method reduces ductility because of the introduction of rolling strain, and there have been cases of fracturing at the time of forming.

[0005] An attempt has been made to deal with these problems by using a mixed structure of ferrite and martensite, thereby establishing both high strength and high ductility. For example, Japanese Examined Patent Application Publication No: 7-100822 (Japanese Unexamined Patent Application Publication No: 63-169334)-discloses a method for manufacturing a high-ductility and high strength chrome stainless steel strip with small in plane anisotropy. In this method, a steel slab containing 10.0% to 14.0% of Cr, 3.0% or less of Ni, and 3.0% or less of Cu, and satisfying the following conditions:

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HEYO MINIST

and

The steel slab is subjected to hot rolling, then cold rolling two or more times, with intermediate annealing therebetween and continuous finishing heat treatment, which consists in heating to a two-phase region temperature ($\alpha + \gamma$ region) of ferrite + austenite, which is the Acl point or higher but 1,100°C or lower, and then cooling to 100°C at a cooling rate of 1 to 500°C per second.

[0006] Also, Japanese Examined Patent Application Publication No. 7-107178 (Japanese Unexamined Patent Application Publication No. 63-169331) discloses a method for manufacturing a high strength chrome stainless steel strip with superb ductility. In this method, a steel slab containing 10.0% to 20.0% of Cr, 4.0% or less of Ni; and 4.0% or less of Cu, and satisfying the following conditions:

and

Ni +
$$(Mn + Cu)/3 = 0.5$$
 to 5.0

The stainless steel strip is subjected to hot rolling, cold rolling one time without intermediate annealing, and continuous finishing heat treatment, which consists in heating to a two-phase region temperature ($\alpha + \gamma$ region) of ferrite + austenite, which is the Acl point or higher but 1,100°C or lower, and then cooling to 100°C at a cooling rate of 1 to 500°C per second.

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[0007] Further, Japanese Examined Patent Application Publication No. 8-14004 (Japanese Unexamined Patent Application Publication No. 1-172524) discloses a method for manufacturing a high-strength chrome stainless steel strip with superb ductility. In this method, a steel slab containing 10.0% to 20.0% of Cr, 4.0% or less of Ni, and 4.0% or less of Cu and more than 1.0% but 2.5% or less of Mo, and satisfying the following conditions:

Total) Acceptangly in the entire ject of the present investing \$\frac{1}{2}\$ the above described problems, and provide a more arringn praintees to a societ with expedient between well and ward zone tongriness, for dist engineering and consociadion structural meterials which require corresion to the high-strongth adoless clear boilting to this invention, is also posigned for vehicle-reinflow. If your injury marchals soon as effort beams, etc., sulfably employed for bicycles, automotive rehicles, relively verific.

Set all output which requires one size in easterner. An object of the consent [6918] It is enother object of the present invention to provide a high-arrengit standers steel sheet with superior The stainless steel strip is subjected to hot rolling, cold rolling and continuous finishing heat treatment! which consists in heating to a two-phase region-temperature (α + γ region) of ferrite + austenite; which is the Acl-point or higher but 1,100°C or lower, and then cooling to 100°C at a cooling rate of 1 to 500°C perisecond. Perise siting and the cooling to 100°C at a cooling rate of 1 to 500°C perisecond. [0008] 191 Also, conventionally, ferritic stainless steel plates such as SUS430; SUS430LX, etc.; having 4.6 to 18% of Cr have been used for steel sheets for bicycle rims, primarily because of their good corrosion resistance. Recently the trend is for reduced weight in bicycles tand there is a demand for reduction in the thickness of bicycle rims, so there is a need to further improve the strength of SUS430, SUS430LX(retc. (450 to 550 MPa). Normally, bicycle rims are manufactured by bending a steel sheet, overlapping the widthwise center and the widthwise ends and seam welding. then cutting to a predetermined length, forming a ring shape, and performing flash butt welding at the abutted cut ends as shown in a cross-sectional diagram (Fig. 5A) taken along line VB-VB. Accordingly, strength, toughñêśsî ând coîró-[0017] To achieve I see objects, according to a first assect of the Ecentric blewight tabbariupar arailean nois [0009]: Vin:light of such problems, a high-strength Cr-containing stainless steel used for bicycle wheel rims is proposed in, for example, Japanese Examined Patent Application Publication No. 7-51737 (Japanese Unexamined Patent Application Publication No. 17-51737) plication Publication No. 1-55363), wherein the chemical composition is adjusted to 11% to 17% of Cr. 0.8 to 3.0% of Ni, and 0.05 to 0.35% of Nb, 0.05 to 0.8% of Cu, and satisfying the following conditions: visites on as the Wile section

C + N < 0.05%

Nb/(C + N) ≅ 2.5 to 7 4 > 5

and a CRE value of 5 to 20.

.21

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0-1 0.5 W - 0.7 4 1.0 180

[0010] This composition exhibits little material deterioration even after welding two or more times, and exhibits a proof stress of 60 kgf/mm² (588 MPa) or more in application to bicycle wheel rims.

[0011] However, while the steel sheets (steel strips) described in Japanese Examined Patent Application Publication No. 7-100822 (Japanese Unexamined Patent Application Publication No. 63-169334), Japanese Examined Patent Application Publication No.97-107178 (Japanese Unexamined Patent Application Publication No.963-169331) sand Japanese Examined Patent Application Publication No. 8-14004 (Japanese Examined Patent Application Publication No. 1-55363) exhibit sufficient workability in ductility and press forming, a problem remains in that sufficient bending properties are not obtained, which is an important feature in working structural materials. Moreover, the toughness of Mo and 0.1 % or more by ross but legs than 2:0% by ਸਰਕਤ ਹ ਿੰਦ Alsਾ the compositi, traibilituarifai zanos griblaw antr-[0012] Also, while the steel sheets (steel strips) described in Japanese Examined Patent Application Publication No. Publication No.7-100822 (Japanese Unexamined Patent Application Publication No.63-169334) (Japanese Examined Patent Application Publication No. 7-107178 (Japanese Unexamined Patent Application Publication No. 63-169331), and Japanese Examined Patent Application Publication No. 8-14004 (Japanese Unexamined Patent Application Publication Publicati lication No. 1-55363) each achieve a high enough strength to contribute to the reduction in the weight of bicycles. The process of manufacturing bicycle rims includes the essential process of punching holes for spokes through the seam weld zones as shown in Fig. 5A-5C, and rims manufactured using the steel sheets (steel strips) manufactured with the techniques described in these four documents generally exhibit cracking at the seam welding zones at the time of punching the spoke holes. Thus, the techniques described in these documents present problems regarding punching workability of the weld zones.

[0013] On the other hand, cold-rolling austenite stainless steels, such as SUS304, to increase strength of bicycle

rims might be conceived, but it should be noted that austenite stainless steels have a low. Young's modulus, is very disadvantageous regarding rim rigidity, and manufacturing costs; are high; due to the use of 8%-by, mass or more of expensive Nitres of the restriction of the property of compressions della essa a continuon. ademptor tier about the

The purity of mass or Mer search to the time.

SUMMARY OF THE INVENTION

[0014] Accordingly, it is an object of the present invention to solve the above-described problems, and provide a high-strength stainless steel sheet, with excellent bending workability and weld zone toughness, for civil engineering and construction structural materials which require corrosion resistance. The high-strength stainless steel, according to this invention, is also designed for vehicle-reinforcing weld structure materials such as pillars, beams, etc., suitably employed for bicycles, automotive vehicles, railway vehicles, and so forth, which require corrosion resistance. An object of the present invention is also to provided a method for manufacturing the stainless steel sheet.

[0015] It is another object of the present invention to provide a high-strength stainless steel sheet with superior corrosion resistance and workability regarding punching of welded zones, which would be, for instance, suitably employed for vehicular use; such as/for bicycle wheel rims and so forth; for example; and also to provided a method for manufacturing the stainless steel sheet. Ordor in this participation is to 0,000 of gardood restricted leaved to 0,000 f. f. [0016] % It should be noted that with regard to the present invention, the term thigh-strength stainless steel sheet refers to stainless steel sheets with tensile strength of about 730 to 1200-MPa; Tensile strength of 730; MPa; exceeds the strength of conventional SUS430 and SUS430LX, and accordingly is sufficiently strong to allow for the reduction of the thickness of bicycle rims. Also, tensile strength exceeding 1200 MPa provides higher strength as a structure, but also provides an increase of the spring-back force, making bending at the time of forming the rim extremely difficult. A: stainless steel sheet, for; bicycle rims preferably exhibits a tensile strength of about 800 MPa; and more; preferably us shown in a gross-sectionar diagram (Fig. SA) taken about the VR VR Accordingly, strength tourseMt.000 toutione [0017] To achieve these objects, according to a first aspect of the present invention; achieve these objects, according to a first aspect of the present invention; achieve these objects, according to a first aspect of the present invention; achieve these objects, according to a first aspect of the present invention; achieve these objects, according to a first aspect of the present invention; achieve these objects, according to a first aspect of the present invention; achieve the present invention; achieve the present invention of the present invention; achieve the present invention of the present invention; achieve the present invention of the present invention o sheet-comprises::a composition including 0.02% by mass or less of Q; 1.0% by mass or less of, Sig 2:0% by mass or less of Mn, 0.04% by mass or less of P; 0.01% by mass or less of S; 0.1 %; by mass or less of Al, 11,%-or more by mass but less than 17% by mass of Cr; 0:5% or more by mass but less than 3.0% by mass of Ni; and 0.02% by mass

> 12<Cr+Mo+1.5 Si<17 (1)

1≤Ni+30(C+N)+0.5(Mn+Cu)≤4 (2)

 $Cr + 0.5 (Ni + Cu) + 3.3 Mo \ge 16.0$ (3)a CRE value of 5 th 2.

[0010] This composition exhibits little meterial definer refine out traffer welding two or more times, and exhibits a

Second stress of 60 agricum* (588 MPa) of the considering the handle whose time (4) = 100.00 agricults while the steel sheets (steel stress considering the steel stress (500.00 agricults). lausnése Examinad Patent Application Philipation | 10011] However while the steet sheets (steet strops of the steet strops of the steet Application | No. 7 400828 regionness (Inexamined Patent Application Publication No. 65-169334) departed Examined Patent wherein, the contents of Cr. N; Si, Mn; Cr. Mo, Ni and Cu are in % by mass and the remainder of the alloy essentially consists of Fe and a structure including 12 to 95% by volume of martensite; and the remainder essentially consisting non No. 1-65363) exhibit sufficient workability in ductility and provide and problem remains in that sufficient sufficient workability. [0018] noThe composition may further comprise one or both of 0.1% or more by mass but less than 2.0% by mass of Mo, and 0.1 % or more by mass but less than 2.0% by mass of Cu. Also, the composition may further comprise 0.0005% 100121 Aire while the steer sheets (steet strips) described in Jacobse Examinad Parent (B., locasam yd %00000.0 ot [00.19] and Moreover, the composition may further comprise 0.5% or more; by, mass but less, than 2.0%, by, mass of Mo and 0:0005% to 0:0050% by mass of B, with the range of C, Al,; Cr, land N, being further restricted to 0:020% by mass or less of C, 0.10% by mass or less of Al, 11.0% or more by mass but less than 15.0% by mass of Cr, and 0.020% by mass:or less of N, and with equations (1) through (4) being replaced by the following equations (5) through (8), 3:16 lication (ye. 1-55363) each achieve a high enough strangth is contribute to the reduction in the weight of blowder. The stocess of manufacturing bicycle rims includes the exsent the rest of punching holes for spekes through the seam (d) (d) ≥ (d) + 10 ≥ (d) + 10

2.0 \leq Ni+30 (C+N) + 0.5 (Mn + Cu) \leq 3.0 charonación de la ger sm<mark>eldor</mark>a tron i : e-cost blew and to vinias and aigydig i ffork ta aksaam a'i 2008/6 da chuk i c'a chuir ag agast ig addir filog chen lachad ba's ji gg

techniques described in those four documents generally extitue its seam werking zonce at the time of

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rat haumana ar mada tenta auntoreta dinocuta dec ic big rate of PCC and faster and wheeling $C_{r+0.5}$ Ni + 3.3 Mo \geq 16.0 crincing one constant normal residual transport [8026] Administrative at remote exemplary embodiments, but a control may contain it as than 6 04% by mass of Cu (80027) - Accordanc to various exemplary embeddingue. In cach a stanifiss storm choot thay de for air material (8) 0.0 ≥ 0.0 100267 According to venous exemplary concediments. The day earling be a hold plied sheet sheet, and the steel wherein, the contents of C, N, Si, Mn, Cr, Mo, Ni and Cu are in % by mass, and wherein the structure includes: 20% by volume or more of martensite, and the remainder essentially consisting of ferrite. Accordingly, the composition and the structure of the high-strength stainless steel sheet is designed for excellent corresion resistance and punching workability of weld zones. [0020] †According to various exemplary embodiments, the composition may contain less than 0:04% by mass of Cu. [0021] According to various exemplary embodiments; the high-strength stainless steel sheet may be for rim material 1933 1) Fig. 3 is an explanational wheel for before the first state of [0022] According to various exemplary embodiments, the steel sheet may be a hot-rolled steel sheet; and the steel [0032] Fig. 4 is an explanatory diagram schemetically this trathing in purion withhis heats bellor-bloomed yeartheads. [0023] According to a second aspect of the present invention, with a manufacturing method for a high-strength stainless steel sheet! the material for stainless steel sheets is subjected to finishing heat treatment by being heated to a temperature within the range of 850 to 1250°C, and then cooled at a cooling rate of 1°C/s or faster, the composition of the material includes: 0.02% by mass or less of C, 1.0% by mass or less of Si-2.0% by mass or less of Mn!10.04% by mass or less of P, 0.01% by mass or less of S, 0.1% by mass or less of Al, 11 % or more by mass but less than 17% by mass of Cry 0.5% or more by mass but less than 3.0% by mass of Ni; and 0.02% by mass or less of N, so as to satisfy the following equations: (1) ithrough (4): A conditional state of satisfy the following equations: (1) ithrough (4): A conditional state of satisfy the following equations: cording to various exertiplary empodiments the moss equivalent (N^{2} - 30 (Ω + M^{2} - 0.5 (M^{2} [0035] (1) Restricting the chronis convetion if Constant a predetermined render allows the control of the mixed of the predetermined render allows the control of the predetermined render allows the predetermined render allow chiamed without loosing ductility structure, and that pign tonsile strength of 730 MPF at motion that (S) 10037] (3) Weld zone toephnass is markedly improved or section amount of Cland Nicontained and also in cluding Ni.

0.31 < oM 8.8 + (u2 + i0) 6.0 + 12

1.038 | Fig. 1.Illustrates the relationship between (0 + i0) 6.0 + i0 bending workability elongation and martenistic 30 amount, with regard to dispel sheet (0.003 to 0.025% of C. 64% of Mn. 0.02% of P. 0.003% of S. 0.002% of Al 13% of Cr 0.5% to 2.5% of N° and 0.003% to 0.005% of 1 separations amounts of C N, and N° are adjusted (\$\frac{4}{2}\) and the volume percentage of manerials is approximately affected from a fertile 4 australia two-phases. state (u. + pregien) at 1000 to 1100°C, so as to visid a ferror in more challe structure [0039] Bending worksbilly was rested ussemilyd % ni and Culare Ni OMrjO (nMrjOkas) vorstnetnomonality inieraku a[0024]গ The:composition:may further include:one or both of 0:1%:or:more by/mass:but less than:2:0%:by/mass:of ∍Mo; and 0.1% or more by maṣs but less than 2:0% by mass of Œu≘Also; the composition may further include 0.0005% amount of (C + N) exceeds 0.00%, panding workability masked elemerates, though ttB to asam vid %0,000 order [0025]: «Moreover, the composition may further include 0.5% or more by mass but less than 2.0% by mass of Morand √0.0005%/to⁻0.0050% by masstof B, with the range of C, Al, Cr, and N} being further restricted to 0.020% by mass or lless of Ca0.10% by mass ordess of Al, 11.0% or more by mass but less than 15.0% by mass of Cr, and 0.020% by mass or less of N, and with the equations (1) through (4) being replaced by the following equations (5) through: (8) m [0041] (4) Restricting the chromium equivalent (Cr. + Mc + 1.53) and the nickel equivalent (№ 4.30 fC + N) + 0.5 (Mr. + Cur to within an even narroyor rance that describes above and also including appropriate amounts of (3) (3) 1 + OM+10≥0.4f (4) and also including appropriate amounts of (3) (3) 2 including and allows are composited to be easily made into a martensite + ferthe muce structure, and that high tensile strength of 800 MPa or higher can are obtained without loosing ductility [0043] (E) Setting the amount of Cricogrammed to year than 1000 by mass and adjusting the amount of Cland N. contained so that (C + N) is within an appropriate range even we then described above in (3) markediv improves (7). The weld zones (3) in arkediv improves (3) bunching workability of the weld zones. [0044] First the reason for restricting the composition of the high strength stainless steel sheet, according to various exemples embediments of the present invention will be described. The updated that in the following 1% by mass: \$2.0 \text{2M+O} 010.0 \\
\text{Will be expressed simply by "%" i.e. that all porcentages in the 10 of the properties unless unless. specifically stated otherwise wherein, the contents of C, N, Si, Mn, Cr, Mo, Ni and Cu are in % by mass, wherein the material is subjected to a finishing heat treatment by being heated to a temperature within the range of 900 to 1200°C, and then cooled at a

cooling rate of 5°C/s or faster, and wherein the composition of the high-strength stainless steel sheet is designed for excellent corrosion resistance and punching workability of weld zones.

[0026] According to various exemplary embodiments, the composition may contain less than 0.04% by mass of Cu. [0027] According to various exemplary embodiments, the high-strength stainless steel sheet may be for rim material to be used for bicycles, unicycles, carts using spoke wheels, tricycles, and wheelchairs.

[0028] According to various exemplary embodiments, the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a cold-rolled steelrsheets. Assure the production of the cold of the steel sheet may be a cold-rolled steelrsheets. Assure the production of the cold of the steel sheet may be a cold-rolled steelrsheets. Assure the production of the cold of the steel sheet may be a cold-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a cold-rolled steel sheet, and the steel sheet may be a cold-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet, and the steel sheet may be a hot-rolled steel sheet may be a hot-rolled steel sheet may b

Earnes blew to visideshow [0029] her Fig.d. is a graph illustrating the relation between bending workability, elongation, and the amount of (C94N); [0030] her Fig.d is a photograph of the structure of a steel plate (Non2-1) taken with an optical microscope; [1,200] [0031] Fig.d is an explanatory diagram schematically illustrating anotch position of a weld-heat-affected zone toughness test: piece pina costs costs on 5 ad year the costs are according vision as a success of guide cost. [2,200]

[0032] Fig. 4 is an explanatory diagram schematically illustrating a punch working test-piece for a seam-weld-zone; and a dignetic figure to be of the conclusion of the seam of the

[0034] A The effects of various elements and structures on the strength, bending workability, and weld zone toughness of high-strength stainless steel sheets, have been studied, and as a result of this study, the following was found; according to various exemplary embodiments:

[0035] (1) Restricting the chrome equivalent (Cr + Mo + 1.5Si) and the nickel equivalent (Ni + 30 (C + N) + 0.5 (Mn + Cu) to within a predetermined range allows the composition to be easily made into a martensite + ferrite mixed structure, and that high tensile strength of 730 MPa or higher can be obtained without loosing ductility.

[0036] (2) Bending workability markedly improves by adjusting the amount of C and N included so that the (C + N) amount is within an appropriate range.

[0037] (3) Weld zone toughness is markedly improved by reducing the amount of C and N contained and also including Ni.

[0038] Fig. 1 illustrates the relationship between (C+N) amount and bending workability, elongation, and martensite amount, with regard to a steel sheet (0.003 to 0.025% of C, 0.2% of Si, 0.2% of Mn, 0.02% of P, 0.003% of S, 0.003% of Al, 13% of Cr, 0.5% to 2.5% of Ni, and 0.003% to 0.025% of N, wherein the amounts of C, N, and Ni are adjusted such that the volume percentage of martensite is approximately 50%) air-cooled from a ferrite + austenite two-phase state $(\alpha + \gamma \text{ region})$ at 1000 to 1100°C, so as to yield a ferrite + martensite structure.

[0039] Bending workability was tested using a cold-rolled steel sheet 1.0 mm in thickness, which was bent 180%, and the minimum radius in (mm) where breaking did not occur was obtained a list, a tensile test was performed on the same steel sheet to measure elongation, thereby evaluating ductility. As can be seen on Fig. 1, from the point where the amount of (C + N) exceeds 0.03%, bending workability markedly deteriorates, though there is hardly any change observed in ductility. Thus, it can be understood from Fig. 1 that the (CarlN) amount greatly affects bending workability. [0040] a varie of fects of various elements and structures on the corrosion resistance and weld zone punching workability have also been studied; and, as a result of this study, the following was found, according to various exemplary embodiments guard. By another policy lead of the same according to various exemplary embodiments guard. By another policy and as a result of this study.

[0041] (4) Restricting the chromium equivalent (Cr + Mo + 1.5Si) and the nickel equivalent (Ni + 30 (C + N) + 0.5 (Mn + Cu) to within an even narrower range than described above in (1), and also including appropriate amounts of Mo and B, markedly improves quenching and allows the composition to be easily made into a martensite + ferrite mixed structure, and that high tensile strength of 800 MPa or higher can be obtained without loosing ductility.

[0042] (5) Adjusting the amount of Cr. Ni, and Mo contained so that {Cr.+ 0.5 Ni + 3.3 Mo} reaches a predetermined value or greater markedly improves corrosion resistance of the parent material and punch hole shearing face.

[0043] (6) Setting the amount of Cr contained to less than 15% by mass and adjusting the amount of C and N contained so that (C + N) is within an appropriate range even narrower than described above in (3) markedly improves the punching workability of the weld zones.

[0044] First, the reason for restricting the composition of the high-strength stainless steel sheet, according to various exemplary embodiments of the present invention will be described. It should be noted that in the following, "% by mass" will be expressed simply by "%", i.e., that all percentages in the following are to be understood to be % by mass unless specifically stated otherwise.

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*[0045] · According to Various exemplary embodiments, carbon (C) is an element which increases the strength of the "steel, and is preferably included at 0:005% of more in order to ensure the desired strength! However, including more "than 0:020% markedly decreases ductility; bending workability, and weld zone toughness; and particularly deteriorates "bending workability and punching workability of weld zones. 'Accordingly, carbon is restricted 0:02% of less with the present invention.' It should be noted that carbon should be 0.02% of less, or more preferably 0:015% or less; from the perspective of bending workability and punching workability of weld zones. Even more preferable is 0:010% or less: 10046]**In Also, for applications where corrosion resistance and punching workability of weld zones are required, such as usage for wheels like bicycle rims or the like, carbon should be 0.020% or less, or more preferably 0:015% or less, or more preferabl

· Silicon: 1.0% or less

Mickel, 0.5% or more but less than 3 0°c

3,

[0047] According to various exemplary embodiments, silicon (Si) is an element which acts as an deoxidant, and also improves the strength of the steel! These effects are markedly recognized by including 0.05% Slici more! However, including more than 1.0% Si hardens the steel sheets and reduces toughness. Accordingly, sillicon has to be restricted to 1.0% or less More preferable is 0.3% or less; for increasing toughness; and to amiliant te pale area at shace equiph (craig region). Lande, amerited 8600 to 1750°C. For tage, strender and 66 an more inckefus prefue ably included. to this end On the other hand, notuding 3 Ch. or morenanted, coreases hardness, esselforword, seeingnamicoringly, in the present invention, nickel is resinated to 0.5% or more but less than 3.0%. More preferable is a range of [0048] According to various exemplary embodiments; manganese (Mn) is the element which generates austenite and with the present invention, 0.1 % or more is preferably included to generate 12 to 95% by volume of austerilte at the time of the finishing heat treatment, at the ferrite + austenite two-phase temperature region ($\alpha + y$ region) (approximately 850 to 1250°C). However, including more than 2.0% Mn reduces the ductility and corrosion resistance of the steel sheet. Accordingly, manganese has to be restricted to 2.0% or less, and more preferably to 0.5% or less for [0036] According to various exemplary embodiments introper "Ni is an elemejápítátsátát főlazátnasíbhakfillitőübe aci of as with critical but a large amount or nitroger includes the kediy deteriorates ductifity wold zone toughness end bending workshifty. Perticularly andluding more than 0.02 a lackedy determinated to %0.04 (200 for hord polyclustrated and ing more than 0.020% mark, dividetar orates purcturing vioritability of the weld zones. Accordingly in the present in

© 1904] ** According to Various exemplary embodiments photosphorous (P) เลาลก element voltation (P) and element

700381 In various exemplary ambindingnity or loss but sent mensions addition to the above-dependent basic com-

[0050] According to various exemplaity embodiments, sulfur (S) is an element which exists in the steel as an inclusion and generally reduces the corrosion resistance of the steel, and is preferably reduced as much as possible in the present invention. However, excessive reduction of S requires a long time for desulfurizing at the time of manufacturing the steel, which raises manufacturing costs. Accordingly, the upper limit for sulfur in the present invention is 0.01%. For better corrosion resistance, 0.005% for less is preferable, alreaded as a regard one grunebodylore diod. [9800] and the sensor blew to specify a specify and reduced the control of the sensor produced to the control of the sensor of the se

[0051]¹2 According to various exemplary embodiments, aluminum (AI) is an element which acts as a decidant and a 0.01-% or more is preferably included, but including more than 0.1% results in a significant generation of inclusions, and corrosion resistance and ductility deteriorate. Accordingly, in the present invention, aluminum is restricted to 0.1% or less? For better ductility, 0.05% or less is preferable. The present invention as a control of aluminum is restricted to 0.1%.

[0053] According to various exemplary embodiments, chromium (Cr) is an element which effectively improves corrosion resistance, which is a feature of stainless steel, and 11% or more, preferably 11.0% or more of Cr need to be included to obtain sufficient corrosion resistance. On the other hand, excessive chromium may deteriorate the ductility

and toughness of the steek sheet, so including 17% or more Cr markedly deteriorates the bending workability. Accordingly, in the present invention, chromium is restricted to 11% or more but less than 17%. Also, 15.0% or more chromium markedly deteriorates the punching workability of the weld zones, so less than 15.0% is preferable. Also, for better corrosion, resistance, chromium included is preferably 12% or more, more preferably 13% or more, and for better punching workability of the weld zones, is preferably less than 14.0%. Moreover, for better bending, workability, less than 15% is preferable, and more preferably less than 14% is preferable to swipped to swipped to swipped as use in wheels like bicycle rims or the like; chromium should be equal to or more than 11.0% but less than 15.0%. For better corrosion resistance, chromium included should be 12% or more preferably 13% or more, and for better punching workability of weld zones, less than 14.0%. Moreover, for better bending workability, less than 15% is preferable, and less than 14% is more preferable.

Nickel: 0.5% or more but less than 3.0%

pale and meninous is a stock dolow themsels on a filt coolid. Anotherwise such as a stock dolow the present invention, 12 to 95% by volume of austenite ance and toughness of weld zones; and generates austenite. In the present invention, 12 to 95% by volume of austenite needs to be generated at the time of the finishing heat treatment, with the ferrite + austenite; two-phase, temperature region (α + γ region) (approximately 850 to 1250°C), for high strength, and 0.5% or more nickel is preferably included to this end. On the other hand, including 3.0% or moremarkedly increases hardness, and ductility decreases. Accordingly, in the present invention, nickel is restricted to 0.5% or more but less than 3.0%. More preferable is a range of 1.8% or more but 2.5% or less. Nickel of 2.5% or less, will yield sufficient, corresion resistance and improve weld zone toughening to accurate the corresponding to the corresponding to accurate the corresponding to the corresponding to accurate the corresponding to the correspondi

[0056] According to various exemplary embodiments, nitrogen (N) is an element-which increases strength; of the steel, as with carbon, but a large amount of nitrogen included markedly deteriorates ductility, weld zone toughness, and bending workability. Particularly, including more than 0.02% markedly deteriorates bending workability, and including more than 0.020% markedly deteriorates punching workability of the weld zones. Accordingly, in the present invention, nitrogen, is restricted to:0.02% or less; and preferably to:0.020%, or less. For better, bending workability. and punching workability of weld zones; 0.015%, or less is preferable; more-preferable is 0.012%, or less; and even more preferable. In applications where corrosion resistance and punching workability, of weld zones; are preferable as use in wheels like bicycle rims or the like; nitrogen should be 0.020% or less. For better bending workability, and punching workability of weld zones, 0.015% or less should be included. More preferable is 0.012% or less, and even more preferable is 0.010% or less.

[9058] In various exemplary embodiments of the present invention, in addition to the above-described basic composition, one or both of molybdenum and copper, and/or boron may be included maxe shorter of pribacock [0.000] and generally rick, and the company resistance of the steet and is proferably reduced as much as possible in the ூர்ப்பOne of both of Molybdenum: 0.1,% or more but less than 2.0% and Copper<u>:0.1% or more b</u>ut less than 2.0% ு the steet which it is estimantification cost? According the upper limit for sulfur is the procent invention (et? 04%) [0059] Both molybdenum and copper are elements which contribute to improved corrosion resistance, and particularly, molybdenum contributes to improved corrosion resistance of the punch hole shearing face of weld zones. In order to obtain such advantages, each of molybdenum and copper need to be included at 0.1% or more. Moreover, 0.5% or more molybdenum should be included to improve corrosion resistance of the punch hole shearing face of weld zones, but copper deteriorates the punching workability of the weld zones; and accordingly the amount of copper should be less than 0.04%. On the other hand, including 2.0% Cu or more saturates the above described corrosion resistance advantages and workability deteriorates instead, so the advantages corresponding to the amount included cannot be obtained, which leads to economic losses. Accordingly, each of molybdenum and copper, should be restricted to 0.1 % or more but less than 2.0%. For better corrosion resistance, 1.0% or more of molybdenum and 1.0% or more of copper should be included, enough as a formation of the outpet should be included, enough as a formation of the couper should be included, enough as a formation of the couper should be included, enough as a formation of the couper should be included, enough as a formation of the couper should be included, enough as a formation of the couper should be included, enough as a formation of the couper should be included, enough as a formation of the couper should be included. [0060] Also, for applications where corrosion resistance and punching workability of weld zones are required, such

as use in wheels like bicycle rims or the like, molybdenum is a crucial element, and 0.5% or more but less than 2.0% need to be included. On the other hand, including 2.0% or more molybdenum saturates the corrosion resistance advantages and workability deteriorates instead, so the advantages corresponding to the amount included cannot be obtained. Accordingly, molybdenum should be restricted to 0.1% or more but less than 2.0%. On the other hand; copper deteriorates the punching workability of the weld zones; and accordingly should be less than 0.04% results and accordingly should be less than 5.00%.

Boron: 0.0005' to 0.0050%b tratiooke the cold in 1923, the sense talent called a view and only other ham one foliate On the other hand if the differentiatric entitles in the above-described render (consistent (f), let it [0061] @ According to various exemplary embodiments; minute amounts of boron (B) act to increase the quenchability of the steel and increase strength; and also markedly improve the punching workability of the weld zones. Such adevantages are observed by including 0.0005% B or more. However, including more than 0.0050% causes the corrosion resistance to deteriorate Accordingly, boron is restricted to the range of 0.0005 to 0.0050%. For improving quenching, 0,0010% or more is preferably included and for better corrosion resistance for 00000% or ries is preferable and 1/(2) [0062]po Also, for applications where corrosion resistance and punching workability of weld zones are required; such ≷as use in wheels like bicycle rims or the like; boron is a crucial element, and 0.0005 to 0:0050% need to be included. - For improving quenching, 0.0010 or more is preferably included, and for better corrosion resistance; 0.0030% or less mium equivalent excends the above-described range (equation 1.4) and the nickel equivalent exceeds the above-described range (equation 1.4) and the nickel equivalent exceeds the above-described range. [0063]#*The composition of the stainless steel sheet according to various exemplar) embodiments of the present invention satisfies the above-described ranges of component elements, and further includes the component elements equivalent is preferably in a range of 14 to 15, and the noticle equivalent is preferably in a range of 14 to 15, and the noticle equivalent is preferably in a range of 14 to 15. [DD71] Further for spolications where corrosion resistance and unching workability of walk zeries are recurred. outened the design of the bloomers of the library states and the states of the states of the season and the second of the second second second to the second s tina jelopejna i teki osti purebli je e prije e, me iš ociA ducting the chromium entirelief is equation (6) is orginable for range 4.2.16 14.6 kpc. charge coulveier in 20 and charge 2.8 to 2.8 \pm 2.00 + mM) 2.0 + (N+O) 08 + iN \pm 1

Cr + 0.5 (Ni + Cu) + 3.3 Mo ≥ 16.0 (Ni + Cu

14.0 ≤ Cr + Mo + 1.5 Si ≤ 15.0 $\frac{10.00 \text{ g/M}}{10.00 \text{ g/M}} = 0.8000.0 \text{ (4.000 feed)}$ (5)

Fociation (8): 0.010 ≤ C + N = 0.01

Sequivalent) and the {Ni+30 (C'±N)+:0:5 (Mn+Cu)} in Equation (2) (or in Equation (6)) is defined as:nickel equivalent.

[0068] Restricting the chromium equivalent and the nickel equivalent to that in equations (1) and (2); and heating to the high temperature (850 to 1250°C) and then cooling, yields a mixed structure of ferrite which has excellent ductility

and martensite which is very strong, so the stainless steel sheet has both excellent ductility and high strengths. [0069] On the other hand, if the chromium equivalent is lower than the above-described range (equation (1)), or if the nickel equivalent exceeds the above-described range (equation (2)), then the ratio of austenite at the time of heating to:the high-temperature becomes too high, and as a result the amount of martensite generated from austenite transformation while cooling becomes excessively large, and ductility deteriorates Also, if the chromium equivalent exceeds the above-described range, (equation (1)), or if the nickel equivalent is below the above-described range; (equation (2)), then the ratio of soft ferrite becomes excessively large, and the strength deteriorates where at anomal of soft and the [0070] and Further; if the chromium equivalent is below the above-described range (equation (1)) and the nickel equivalent is below the above-described range ((equation (2)), then the austenite is transformed to ferrite during cooling and as a result hardenability deteriorates; the amount of martenaite decreases and the strength drops: Moreover, if the chromium equivalent exceeds the above-described range (equation (1)) and the nickel equivalent exceeds the abovedescribed range (equation (2)); then residual austenite which has lower strength is generated instead of martensite, and as a result high strength cannot be obtained. From the balance, between strength and ductility, the chromium equivalent is preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose) (1) another preferably in a range of 14 to 15, and the nickel equivalent 2 to 3dpuose (1) another preferably (1) another [0071] Further, for applications where corrosion resistance and punching workability of weld zones are required, such as use in wheels like bicycle rims or the like, the range of 14.0 to 15.0 for the chromium equivalent in equation (5), and the range of 2.0 to 3.0 for the nickel equivalent in equation (6), are preferable. It should be noted that in equation (6), Cu is calculated as being zero when "less than 0.1%" is included. Also, from the balance between strength and ductility, the chromium equivalent in equation (5) is preferably in the range 14.2 to 14.6, and the nickel equivalent in equation (6) in the range 2.2 to 2.8.

- Equation (3): Cr + 0.5 (Ni + Cu) + 3.3 Mo ≥ 16.0 • Equation (7): Cr + 0.5 Ni + 3.3 Mo ≥ 16.0
- [0072] The left side of Equation (3) {Cr + 0.5 (Ni + Cu) + 3.3 Mo} (or Equation (7), however, Cu is an unavoidable inclusion and accordingly is not included in the Equations) is a factor relating to corrosion resistance, and with the present invention, the amounts of Cr, Ni, Cu, and Mo included are adjusted so that {Cr + 0.5 (Ni + Cu) + 3.3 Mo} is 16.0 or higher. This yields corrosion resistance equal to originate than that of SUS430 or SUS430EX; and further; the corrosion resistance of the punch hole shearing face of weld-zones is markedly improveded that hold be noted that for better corrosion resistance, {Cr + 0.5 (Ni + Cu) + 3.3 Mo} is preferably 17.0 or higher. Also, for better corrosion resistance (Cr+30.5 Ni + 3.3 Mo) is ipreferably 17.0 or higher. Assistance and punching workability of weld-zones are required; such as use in wheels like bicycle rims or the like, for better corrosion resistance, the left side-of-equation (7) {Cr+0.5 Ni+3.3 Mo} is preferably 16.0 or higher, and even more preferably, 17.0 or higher.

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Equation (4): 0.006 ≤ C + N ≤ 0.030
 Equation (8): 0.010 ≤ C + N ≤ 0.02

[0074] The {C + N} in equation (4) (or equation (8)) is a factor affecting strength, bending workability, weld zone toughness, and punching workability of the weld zones. In the present invention, this is restricted to the range of 0.006 to 0.030. If {C + N} is less than 0.006, then the strength of the martensite structure is too low, so even if a ferrite + martensite mixed structure is formed, high tensile strength of 730 MPa or more cannot be realized. On the other hand, if $\{C + N\}$ exceeds 0.030, then bending workability and weld zone toughness deteriorates markedly. It is thought that the reasons is that when the amount of C and N included is great, the difference in hardness between the soft ferrite and the hard martensite becomes extremely large, such that stress accumulates at the boundary thereof at the time of bending, and accordingly breakage occurs more easily. For higher strength, $\{C+N\}$ should be 0.010% or more, and more preferably 0.012 or more. Also, for better bending workābility, {C ₽N} Should 5e 0.020 or/less⇔ enti-nierelw [0075] Moreover, if:{C!+:N}:exceeds:0.02; then weld zone punching/workability markedly/deteriorates://The@reason that weld zone punching workability deteriorates, according to various exemplary embodiments, is that of the mixed structure of ferrite and martensite which is generated after welding, there is a great amount of C and N in solid solution in the martensite from transformation of the austenite which has great solid solubility of C and N; so the strength of the martensite increases, and the difference in strength with the soft ferrite becomes excessively large (a) noticued [0076] For better weld zone punching workability, {C + N} should be equal to or more than 0.010 but 0.02 or less, more preferably 0.020 or less, and even more preferably 0.017 or less.

f[0077] to Also, for applications where corrosion resistance and punching workability of weld zones are required; such as use in wheels like bicycle rims on the like; {C + N} in equation (8) should be equal to or more than 0.010 but 0.02 or, less; more preferably 0.020 or, less; more preferably 0.020 or, less; land even more preferably 0.017 or less; a more preferably 0.020 or, less; land even more preferably 0.017 or less; a more preferably 0.020 or, less; land even more preferably 0.017 or less; a more preferably 0.020 or, less; land even more preferably 0.017 or less; land even more preferably 0.017

formed of iron (Fe) in addition to the above described components. The term ressentially formed of Fertmeans that impurities other than Fe are still unavoidably included. Also, up to about 0.1-% of Cu may be included by being mixed in from scrap iron which is part of the material but applications where corrosion resistance and punching workability of weld zones are required, such as use in wheels like bicycle rims or the like, Cu as an unavoidable impurity is preferably kept to less than 0.04%; If Curreaches 0.04% or more, the marten site excessively hardens in the same way as in the case/wherethe (@/#:N)rexceeds 0:02%; thereby deteriorating the weld zone punching workability. Examples of other unavoidable impurities besides Cu include small amounts (around 0.05%) of alkali metals alkaline earth metals frare? earth elements, transition metals? and the like. Small amounts of such elements being included do not interfere with the advantages of the present invention in any way is suggested at the advantages of the present invention in any way is suggested as the advantages of the present invention in any way is suggested as the advantages of the present invention in any way is suggested as the advantages of the present invention in any way is suggested as the advantages of the present invention in any way is suggested as the advantages of the present invention in any way is suggested as the advantages of the present invention in a suggested as the advantages of the present invention in a suggested as the advantages of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the advantage of the present invention in a suggested as the present invention in a suggested as the advantage of the present invention in a suggested as the present invention in a suggested as the advantage of the present invention in a suggested as the present in the advantage of the present invention in the present invention in the present in th [0079] lo-The structure restrictions of the high-strength stainless steel sheet according to the various exemplary em bodimentssofthe present invention are described below. The high-strength stainless steel sheets according to the present invention; has a mixed structure of martensite and remainder of ferrite; wherein the martensite is equal to or more:than 1/2% by volume but equal to or less than 95%, preferably equal to or less than 85% and more preferably 20% or more but 80% or less lift the martensite is less than 12% by volume rductility is excellent obtaining high strength with a tensile strength of 730 MPa of more becomes substantially difficulted one sessenadi slimet to toucous [0080] of On the other hand, if martensite exceeds 95% by volume, strength of a tensile strength of 730 MPa or more can be obtained? but the ratio of ferrite; which has excellent ductility; is too low, so the steel sheet loses ductility, and binding/workability deteriorates/\Forapplications wherecorrosion@resistance and punching workability of weld zones are required, such as use in wheels like bicycle rims or the like, martensite should be included at 20% by volume or more preferably 50% or more and while increased strength is desirable, 85% or more martenaite by volume makes bending workability of forming rims and the like in particular markedly difficultall act to amin aloyaid at liabedwini asu [0081] OCA preferred manufacturing method of the high-strength stainless steel sheet according to the present invention mass of B. with the range of ChAll Or and N. being further conscious to 0.020% by mass or less of wolfd bedingebrain [0082]s According to various exemplary embodiments, material for stainless steel sheets (hot-rolled steel sheets or cold-rolled steel sheets) is subjected to a finishing heat treatment which consists in being heated to a temperature within the range of 850 to 1250°C, preferably held at this temperature for 15 seconds or longer, and then cooled at a cooling rate of 1°C/s or faster, preferably 5°C/s or faster. The material comprises: the above-described component composition including 0.02% by mass or less of C, 1.0% by mass or less of Si, 2.0% by mass or less of Mn, 0.04% by mass or less of P, 0.01% by mass or less of S, 0.1% by mass or less of Al, 11% by mass or more but less than 17% by mass of Cr. 0.5% or more by mass but less than 3.0% by mass of Ni, and 0.02% by mass or less of N, so as to satisfy the following equations (1) through (4),

ą;

35

$$12 \le Cr + Mo + 1.5 Si \le 17$$
 (1)

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$$1 \le Ni + 30 (C + N) + 0. \le (Mn + Cu) \le 4$$
 (2)

whoreign the contrate of Cook St. Mn. Or Mooklich & Quarting Seignass The material further includes 0.04% or less 3) at betsed it bus treatment tend prints in Cr+0.5 (Ni+, Cu).+3.3 Mo ≥ 16.0 arody with up of betsed it is a contract to the temparature with life range of 900 to 1200° C to efor-child on the remograture for 15 seconds onlonger and then cooled at a cooling rate of \$10/s or faster , parature is lower than 900°C, even if the neating tensioned to leds the Art transformation point, then the transformation wherein, the contents of C; N, Si, Mn, Cr, Mo, Ni and Cu are in % by mass, a sugalate of stare? most beeds notionally The material may further comprise one or both of 0.1 % or more by mass but less than 2.0% by mass of Moyand 0.1% or more by mass but less than 2.0% by mass of Cu, and/or 0.0005% to 0.0050% by mass of B, with the remainder generated by transformation from austenite during confer or achieved although of transformation from austenite during confer or achieved although of transformation from austenite during confer or achieved although of the conference of the confere [0083] The obtained hot-rolled steel sheet or cold-rolled steel sheet is preferably heated to a temperature in the range of 850 to 1250°C (which is the two-phase temperature region (α + γ region) of ferrite + austenite) as finishing heat/treatment? According to various exemplary embodiments the heat treatment atmosphere is not particularly restricted, and may be a reducing or oxidizing atmosphere. In the event that the heating temperature is lower than 850°C, sufficient/recrystallization/does not occur, and even in the event that the heating temperature exceeds the Ad1 transformation point; the transformation speed from ferrite to austenite is slow, and there may be cases where sufficient martensite cannot be obtained following cooling. [0084] PioAlso, in the event that the heating temperature exceeds 1250°C7 the ratio of δ -ferrite increases, so the ratio of austenite is insufficient; and the 12% or more by volume of martensite generated by transformation from austenite

during cooling cannot be ensured. Note that the two-phase structure of ferrite a stably obtained in the

temperature range of 900 to 1200°C, and accordingly is preferably heated to this temperature range. Also, heating to 950°C or higher is preferable in order to obtain a uniform structure with sufficient recrystallizations at 1900 approximation of the contraction o [0085] C Also, the hot-rolled steel sheet or cold-rolled steel sheet is preferably maintained at the above heating temperature for 15 seconds or longer. If the holding time is less than 15 seconds, recrystallization may be insufficient, and transformation from ferrite to austenite is also insufficient, so the desired ferrite + austenite two-phase structure cannot be obtained; and sufficient strength cannot be achieved. It should be noted that from the perspective of productivity of finishing heat treatment; the heating time is preferably. 180 seconds or less teaton to Discorded sout order of the how sign [0086] 5. According to various exemplary embodiments, this hot-rolled steel sheet or cold-rolled steel sheet is cooled to the Ms point (the temperature at which the austenite begins transformation to martensite during cooling) corclower, preferably 200°C or lower; as the cooling; stop temperature, at a; cooling; rate of 1,°C/s, or faster; and preferably 5,°C/s or faster. After reaching the cooling-stop temperature, the cooling may continue at that rate down to room temperature, but there is no particular need for temperature control here, and accordingly the sheet may be left to cool to room temperature:. At a slow rate where the average cooling rate from the heating temperature to the cooling-stop temperature (average cooling rate), is slower, than 1,°C/s, part of the austenite is transformed into ferrite during cooling so the amount of ferrite increases, and the 12% by volume or more of martensite generated by transformation from austenite during cooling cannot be ensured; and consequently, the goal of high strength cannot be achieved. In order to ensure stable strength, a cooling rate of 5°C/s or faster is preferable. While there is no particular upper limit set for the cooling rate from the heating temperature, generally 100° C/s or slower is preferable. It should be noted however, that excessively fast cooling may result in:cooling:irregularities,; and unevenness on the steel sheet, sau ഒല ദ്യാരം ഉട [0087] For applications where corrosion, resistance and punching workability of weld zones are required, such as use in wheels like bicycle rims or the like, the material for stainless steel sheets (hot-rolled steel sheets or cold-rolled steel/sheets), further, includes; 0.5%, or more; by, mass but less than 2.0%; by, mass of Mo; and 0.0005% to 0.0050%; by mass of B, with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, 0.10% by mass or less of Al; 11:0% by mass; or more but less than 15:0% by mass of Cr; and 0.020% by mass; or less of N, and with equations (1) through (4) being replaced by the following equations (5) through:(8); and a second costs confor of m nither the range of 850 to indicate above neld all environments of north reaches or notice, and the cipological theird throng Mytherash กระเบียก เลยาการและ ค.ศ. 2011 (1.5 and พ.ศ. 2013 พ.ศ. เลยาการเลยาการเลยาการเลยาการเลย เสยาการ วิทาที วิทาศ (1.5 and เกาะสะพาศ มหาการเลยาการเลยาการเลยาการเลยาการเลยาการเลยาการเลยาการเลยาการเลยาการเ ି । ନିର୍ମ୍ବର ଓଡ଼ିଆ ମିଲି ବିକିଥିଲି ଓଡ଼ିଆ କଥାଚିତ୍ର ଓଡ଼ିଆ ନିର୍ମ୍ବର ଓଡ଼ିଆ ପ୍ରଥମ ଓଡ଼ିଆ ଅଟି । ୧୯୮୯ ଓଡ଼ିଆ ମିଳି ଓଡ଼ିଆ ପ୍ରଥମ ଓଡ଼ିଆ ସମୟ ଓଡ଼ିଆ ଓଡ଼ିଆ କଥାଚିତ୍ର ଅଟି । The softeen bolistomic assemble on 10% (a) mass of Cr (c = 0.0 = 0.0 ≥ (u) + 0.0 (u) + 0.0 + (v) + 0.0 ≥ (v) + 0.0 (u) + 0.0 grand de lasta en sasta de mano

 $Cr + 0.5 Ni + 3.3 Mo \le 16.0$ (7)

 $\Delta > 0.010 \le C + N \le 0.020 + 0.1$ (8)

wherein, the contents of C, N, Si, Mn, Cr, Mo, Ni and Cu are in % by mass. The material further includes 0.04% or less of Cu as an unavoidable impurity, wherein the material is subjected to finishing heat treatment and is heated to a temperature within the range of 900 to 1200°C, preferably held at this temperature for 15 seconds or longer, and then cooled at a cooling rate of 5°C/s or faster.

[0088] The reason why the finishing heat treatment temperature is set to 900 to 1200°C is that if the heating temperature is lower than 900°C, even if the heating temperature exceeds the Ac1 transformation point, then the transformation speed from ferrite to austenite is slow, and the 20% by volume or more of martensite generated by transformation from austenite during cooling cannot be obtained. Also, if the heating temperature exceeds 1200°C of then the ratio of δ. ferrite increases, so the ratio of austenite becomes insufficient, and the 20% by volume or more of martensite generated by transformation from austenite during cooling cannot be achieved. Also, heating to 950°C or higherals preferable in order to obtain 50% by volume or more of martensite. To read a feed a 30°C to the heating to 40°C or higherals from the heating temperature to the cooling rate is set to 5°C/s or faster is that, at a slow rate where the average cooling rate from the heating temperature to the cooling-stop temperature (average cooling rate) is slower than 5°C/s, the amount of the austenite transformed into ferrite during cooling increases, and the 20% by volume or more of martensite generated from the transformation of austenite during cooling cannot be achieved, and consequently the goal of high strength cannot be achieved. While there is no particular upper limit set for the cooling rate year also advance a harmone is preferable.

[0090] According to various exemplary embodiments, the hot-rolled steel sheet or cold-rolled steel sheet is preferably subjected to acid wash. The finishing heat treatment is normally performed in a continuous annealing furnace for coils, and a batch annealing furnace for cutlength sheets.

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[0091] According to various exemplary embodiments; the hot-rolled steel sheet or cold-rolled steel sheet manufact tured this way is subjected to bending working and the like according to the application thereof, and is formed into pipes, panels, and the like. The articles thus formed are then used as, for example, vehicle reinforcing well structure materials such as pillars, bands, beams, and the like, for railway vehicles, bicycles, automobiles, busses, bicycle rims, and the like. The welding method for this structural members is not particularly restricted. General arc welding methods such as MIG (metal-arc inert gas welding), MAG (metal-arc active gas welding); and TIG (gas tungsten arc welding); spot welding, seam welding and other resistance welding methods, high-frequency resistance welding as seam welding, and high-frequency induction can be performed. Additional oxiders have 0.000 states own or buildow. [1970] [0092] According to various exemplary embodiments, the processes up to before the finishing heat treatment process may be conventional processes, and there is no particular restriction on these processes other than preparing the components for the composition of the molten steel at the time of melting the steel. Methods generally employed for mánufacturing martensitic stainless steel sheets can be applied heré without chánge! Preferred processes up to before longitudinal direction is parallel to the rolling direction. ยายวิจักรม เวา 20° beavollot อัลาล inemisent neet pointaint, drif [0093] For example, a steel converter of electric furnace or the like is used so as to meet the scope of the present invention rand secondary refining is performed by VOD (Vacuum Oxygen Decarbunzation) or AOD (Argon Oxygen Decarburization) so as to produce the steel: The produced steel can be formed into slabs with known casting methods: From the perspective of productivity and quality, continuous casting is preferably applied for slabs. A steel slab obtained by continuous casting is heated to 1000 to 1250°C, subjected to ordinary heat rolling conditions, such as being formed into sheet bars 20 to 40 mm in thickness by reverse milling, and then formed into hot-rolled steel sheets 1.5 to 8.0 mm in thickness as desired by a tandem mill: Alternatively, hot-rolled steet sheets 15 to 8.0 mm in thickness as desired may be formed with the reverse mill alone. The hot-rolled steel sheet is subjected to batch annealing at preferably 600 to 900°C as necessary, and descaled by acid wash or the like. Also rdepending on the application thereof, the hotrolled sheet is annealed and acid-washed, then subjected to cold-rolling to form cold-rolled steel sheets 0.3 to 3.0 mm in thickness. If necessary, the cold-rolled steel sheets are subjected to continuous or batch annealing at 650°C to 850°C; and acid washing! For better productivity, the finishing heat treatment according to the present invention is preferably carried out for the hot-rolled or cold-rolled steel, without annealing or acid washing or and more beniated and [0094] To The present invention is described in further detail, according to the exemplary embodiments below: shown in Fig. 3. Tecting is performed conforming to the should be 22 22 22 42 at 150°C. The absolution anergy is calculated, and the wald-heat-offected rone toughnose is the control evalue vE.50 (Jrom2) obtaine 2319MAX3 the about phon onergy varied by the eaginal socron lead of the lead. The exerage of the five specimens is taken as the value to the side sheet. A VE. gt of 40 word to make the weld-heet afteored consideral admixed sufficient for practical use.

[0095]: With the hot-rolled stainless steel sheets of the composition shown in Table 12 of Table 2 as material, finishing heath realment processing is performed by a batch annealing furnace of the conditions shown in Table 3 or Table 4; and then washed with acid of the obtained steel sheet 3 mm in thickness is subjected to (1) metal structure observation; (2) tensile testing; (3) corrosion testing. (4) bending testing; and (5) weld-heat-affected zone toughness testing. The testing is as follows. Note that the hot-rolled steel sheet which is the material was made by heating at 100 kgfing of steel of molten in a high-frequency furnace to 1200°C, and finished by hot-rolling to a thickness of 3 mm by a reverse mill.

(1) Metal Structure Observation

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10106] The proporties of cold-rolled steel shoars or rolled as a shears of the from the proporties of cold-rolled steel shears are seen to thickness. X or mm X 10 mm X 10 mm) for metal structure of services of the from the from the proportion of the from the from

[0097] Five JIS Nord3 Batensile test specimens are taken from the obtained steel sheet so that the tensile direction matches the rolling direction, tensile testing is executed conforming to the stipulations of JIS Z 2241/50 as to obtain the tensile strength (TS) and elongation (E1) which were averaged allor-bloods at the emitted at the sum of the strength (TS) and elongation (E1) which were averaged allor-bloods at the emitted at the sum of the strength (TS) and elongation (E1) which were averaged allor-bloods at the sum of the sum of the strength (TS) and elongation (E1) which were averaged allor-bloods at the sum of t

(3) Corrosion Test

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[0098] Two corrosion specimens (size: t X 70 mm X 150 mm) are taken from the obtained steel sheet, and cyclic corrosion testing (also known as CCT) is performed under the following conditions with one face the reof as the testing

face. Following the test, the specimens are immersed in concentrated nitric acid of 60°C to remove rust, the number of points of rust on the test face is counted visually, and averaged between the two specimens, thereby evaluating the corrosion resistance of the steel sheets. Nine or less rust spots means corrosion resistance with no problems for practical use, season sendomotro acroyonal secondar restriction to the consent abused and practical users Corrosion testing conditions: five cycles of the following cycle; காக்காகவாக உர்நான் கொள்ள ஓள்ளல் காக காக வரி [0099] v.Misting with saltywater (5% NaCl solution at 35°C) for two hours, specified as a second consequent Covince that [0<u>ქ00]-გ drying forfour hours (60% and relative humidity of 30% or lower) გო</u>ქაძა ბოვ დონ სახელდე ანცხათ ცავა [0101] wetting for two hours (50°C and relative humidity of 95%) and do not output from the least row [0092] According to various examplery embodiments the properties to before the finite that heaftreatment process may be conventional processes, and there is no particular instruction on these processas when th**test enter the gnitenes** (A) combonants for the composition of the matter steel a continuous traitment that see. Methods go length simpleyed for [0102] a Three specimens (size: t X 25 mm wide X 70 mm long) are taken from the obtained steel sheet such that the longitudinal direction is parallel to the rolling direction, subjected to 180° bending with an inner radius of 0.75 mm, 1.5 mm; 2.0 mm, and 3.0 mm; following which the outer side of the bend is observed with a magnifying; glass to inspect of cracks, and the minimum bending inner radius (mm) with no cracking occurring is obtained. Smallest bending inner radius of less than t (e.g., less than 3.0 mm in the event that t = 3.0) means bending workability sufficient for practical use. From the persodetive of productivity and quality continued is skilled in a creferably applied for slabs. A clear slab obtained (5):Weld-Heat-Affected Zone, Toughness, Test: The Control of the 1982 for 860 for all between an end and a supervision year. into sheat bars 20 to 40 mm in thickfiess by reversh maters and face byreed into hot-rolled steel sheets 1.5 to 8.0 mm [0103]: ¿Two specimens (size: 1 X:150 mm; wide, X:300, mm long) are taken from the obtained steel sheet for fabricating joints, abutted with each other so that the faces of the sheets, in the thickness direction thereof parallel in the rolling direction face-one another, and welded together so as to form a welded joint by MIG welding vThe conditions for MIG welding here are JIS Y308 for the wire; electric current of 150An voltage of 191/2 welding speed of 9 mm/s; shielding in thickness. If necessary the colouring to gap toor brightness of necessary the colouring to gap toor brightness. [0104] 19 Five USZ-2202 No. 4; sub-size Charpy impact testing specimens; (size: 40, mm, thick X, t, wide X, 55 mm, long) are obtained from the obtained welded joint by machining such that the longitudinal direction of the specimens is parallel to the width direction of the steel sheet. A notch is formed at a heat, affected zone; 1, mm, from the binding portion has shown in Fig. 3. Testing is performed conforming to the stipulations of JIS Z 2242 at -50°C, the absorption energy is calculated, and the weld-heat-affected zone toughness is evaluated from a value vE_sn (J/cm²) obtained; by dividing the absorption energy value by the original section area of the notch base. The average of the five specimens is taken as the value for the steel sheet. A vE 50 of 40 J/cm2 or more means that the weld-heat-affected zone toughness is sufficient for practical use. -

[01.05] it The results of the tests are shown in Table 3 and Table 4: Each of the examples according to the present invention have high tensile strength of 730 MPa or higher, excellent corrosion resistance, and excellent bending workability and weld heat-affected zone toughness. On the other hand, with the comparative examples which are outside the range of the present invention; either the tensile strength is less than 730 MPa corrosion resistance is deteriorated, bending workability, is deteriorated, or weld heat-affected zone toughness is deteriorated about a world as a prities. Time excess a volume to a sensition to the present invention to less than 2005 to a sensitive result of the present invention to less than 2005 to a sensitive result of the present invention.

(1) Metal Structure Observation

[0106] The properties of cold-rolled steel sheets are inspected. A hot-rolled steel sheet 3 mm in thickness, of the steel-No. 1K in Table of from the Example of is subjected to annealing of being held at 700% for it 0 hours and then gradually cooled; and descaled with acid wash. The hot-rolled annealed sheet is rolled with a reverse mill by cold rolling to a thickness of it. 5 mm, subjected to finishing heat treatment of being held at 1,000% of or 30 seconds, and then cooled to a cooling stop temperature of 1,00% of at a rate of 15% of s, and descaled by immersion in a 60% of mixed acid (1,0% by, mass, of nitric acid at 3% by mass, of hydrofluoric acid), thereby obtaining a cold-rolled steel sheet with a thickness t of 1.5 mm. The same tests as the hot-rolled steel sheet in Example 1 are performed in this example; s, mulov enters to 1.5 mm. The only difference is that the welding for testing weld zone toughness is TIG welding (electric current of 95A, voltage of 11v, welding speed of 400 mm/min, and flow of shield gas of 20 liters/min for front (electrode) side and 10 liters/min for rear side. The results show that the martensite percentage by volume was 73%, CCT rust count is zero, smallest inner bending radius; is 2.75 mm (1/2t, i.e., half of the sheet thickness). Tensile strength is 975-MPapand breaking elongation is 10%. Weld-heat-affected zone toughness show the charpy impact testing value; (vE₂₅₀) at 50% to be 70 J/cm². Thus, it is confirmed that cold-rolled steel sheets have approximately the same properties as hot-rolled steel sheets.

131 Conosion Test

Example 3

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abugations it sents the method of the first performance under the conditions shown in Table 7, and Table 8

is performed on stainless cold-rolled steel sheets of the composition shown in Table 5 and Table 6; and washed with acid. The obtained steel sheet having thickness t of 0.7 mm is subjected to the (1) metal structure observation? (2), tensile test, and (3) corrosion test, as with the Example 1. The cold-rolled steel sheet used as the material is manufactured by heating a 100 kgf ingot of steel of the composition shown in Table 5 and Table 6 molten in a high-frequency furnace to 1200°C, finished to 3 mm thickness by hot rolling with a reverse mill, subjected to annealing of being held at 700°C for 10 hours and then gradually cooled, descaled with acid washing, and then the hot-rolled annealed sheet is rolled by cold-rolling with a reverse mill to a thickness of 0.7 mm.

[0109] Fig. 2 shows a structure photograph taken with an optical microscope of the steel sheet No. 2-1 (Table 7), as an example of the (1) metal structure observation results. The black portions are the ferrite structure, and white portions are the martensite structure. The volume percentage of martensite structure in this view is 73%.

[0110] The results are shown in Table 7 and Table 8.

[0111] Further, two seam weld zone punching workability specimens shown in Fig. 4, assuming a bicycle rim such as shown in Figs. 5A through 5C, each t X 50 mm wide X 300 mm long are taken from the obtained cold-rolled steel sheet, the two were overlaid, and subjected to seam welding in the lengthwise direction with an automatic seam welder, under welding conditions of electrode width of 6 mm, welding speed of 120 cm/min, application pressure of 3 kN, and welding electric current of 8 kA. Five holes, 4 mm in diameter are punched at 50 mm intervals from the edge of the obtained welded piece along the middle, assuming bicycle spoke holes. After punching, cracks are inspected for around all holes at a magnification of 10 times with a magnifying glass. Also, the specimens following breaking observation are then subjected to corrosion testing in the same may as with (3), and whether or not rust at the hole portions (punch shearing faces) was observed by eye. While this seam weld tone punching workability test is specifically performed with application to steel sheets for bicycle rims in mind as shown in Fig. 5, application may be made to other usages in the same manner.

[0112] The obtained results are also given in Table 7 and Table 8.

[0113] Each of the examples of the present invention satisfying the suitable range for applications requiring corrosion resistance and weld zone punching workability, application to wheels for example, have high tensile strength of 800 MPa or higher, excellent corrosion resistance, no cracks are observed in punching of the weld zones, and the hole faces of the punch holes have excellent corrosion resistance. On the other hand, examples of the present invention outside of the suitable range (indicated by being in brackets []) for applications requiring corrosion resistance and weld zone punching workability, application to wheels for example, either have a tensile strength of less than 800 MPa, exhibit some deterioration in punching workability of the weld zones, or exhibit some deterioration in the corrosion resistance of the punch hole portions.

Example 4

- [0114] The properties of hot-rolled steel sheets are also inspected. The hot-rolled steel No. A in Table 5 from Example 3 is subjected to finishing heat treatment of being held at 1000°C for 30 seconds and then cooled to a cooling stop temperature of 100°C at a rate of 30°C/s, and descaled by immersion in a 60°C mixed acid (15% by mass of nitric acid + 5% by mass of hydrofluoric acid), thereby obtaining a hot-rolled steel sheet with a thickness t of 2.0 mm.
- [0115] The hot-rolled steel sheet used as the material is manufactured by heating a 100 kgf ingot of steel of the steel No. A composition, shown in Table 3, molten in a high-frequency furnace to 1200°C, finished to 2.0 mm thickness by hot rolling with a reverse mill. The sheet is subjected to the same tests as the cold-rolled steel sheet in Example 3.
- [0116] The obtained hot-rolled steel sheet is subjected to the (1) metal structure observation. (2), tensile test, and (3) corrosion test. Further, two seam weld zone punching workability specimens, each t X 50 mm wide X 300 mm long, are taken from the obtained hot-rolled steel sheet, the two are overlaid, and subjected to seam welding in the lengthwise direction with an automatic seam welder, under welding conditions of electrode width of 6 mm, welding speed of 100 cm/min, application pressure of 7 kN, and welding electric current of 12 kA. Five holes, 4 mm in diameter are punched at 50 mm intervals from the edge of the obtained welded piece along the middle, assuming bicycle spoke holes. After punching, cracks are inspected for around all holes at a magnification of 10 times using a magnifying glass. Also, the specimens following breaking observation are then subjected to corrosion testing in the same way as with (3), and

whether or not rust at the hole portions (punch shearing faces) was observed by eye.

- [0117] As a result, the volume percentage of martensite structure is 75%, and the CCT rust count is zero. Tensile strength is 920 MPa, and breaking elongation is 12%. No cracks are observed in punching of the weld zones, and the hole faces of the punch holes have excellent corrosion resistance. Hot-rolled steel sheets thus have approximately the same properties as cold-rolled steel sheets.
- [0118] According to the present invention, high-strength stainless steel sheets with high tensile strength of 730 MPa or higher, and excellent corrosion resistance, bending workability, and weld zone toughness, and further high-strength stainless-steel sheets with excellent weld zone punching workability, can be provided easily and inexpensively, thus yielding marked industrial advantages. The high-strength stainless steel sheets according to the present invention can

be applied to usages requiring corrosion resistance and weld zone punching workability, such as application to bicycle rims; unicycles; carts using; spoke wheels, tricycles, wheelchairs; and the like.pn: John sense instruction and Tile as Section 2 and 15w as their coincides on 180 bits and about CHEST OF SHOWING SIT BY THE TEAT BY USE DEFO FOR IT table cap by bactering a 1900 kg/s lings in large of the doctyres if the collection of the Collection of doctin bed called to gallsound to begradus. We estawant out it also not we apply that to the finance of the members of a. A to be a formal alead from graduatividament, la support of a support and from including anneal oblation sheet a mytled by Lata mitting with a reverse mill to में thic nase, को 🗥 🧸 (ur.69). Find chows a unartial educação tecchimicada, en como pacação o thusaga maetrico Port Rapia Court an example of the CO metar supporte observation results. The common error the feater and include and virus portions are the maint rest; structure. The volume percentage of the control of a core of this view is 78% [0110] The results are shown a Time I and Table As an intermediation of parameters of the first abusing can-101/11] Further two seam weld some parching for the comac drawn in Figs. 6A through 5C laught X 50 mm weak in the pare taken from the paralmed colorivited green sheet this two were overland, and subjected to scent within to the test discriber with an automatic second virtuel. and this to be award his citage himned of the concentration. under weiding conditions of electropy until a 6 mm wich with a special or all their minds self-when welders evenic current of 6.1.2. Ewaitions is a new process mapping to high recent and it sould common against and obtained welded bisec along the marks, is reunalise to the second chevreadh chikashd ghri sifist and siboda eath The first of the former and the configuration open a by election id whether or no, rust at the hole hemons, insured, ere then subjected to company testing it the same ray are to shearing faces; was lobseryed by eval 1/9th; this source with hor adding worker-lifty test is specifically performed: Fig. 6. applies the may be made to other usablet with application to sleet sheets for brivior tros in nord as a proin the same manner [0112] The obtained tax offs are also given a Timble 1 or the 19113 - Back of the examples of their pagetimention, within the ablencing for each send new fire connector. resistance and weld cone ou nothing vioritability out was not to words as imple trends in tension scrength of 800 MPs or bigher, excellent corrosom desistance, no circles and in punching of the wells, ones and the autotages of the number bases may exactional to make a factor of a mingurer two. Indigent his sefect examples to the contract of the contract o osembros à mercieos notaumo apsitupas encorrato 🐰 o 🛒 o libraria la rigoria formationa agrico didentico situlita moteba aPM COF and sealth disperse aftered a ROD MAG za religional workstyllago velktadow gwelanog er ez exhibit semie detempration in remandir, y rikahim r so as some earner than in the pornasion resistance of the numb hold of hour

Example 4

- [0114] The properties of high-rotes used aberra alones. The horseled size of Colonia had blow a Exercise dors princed a official mant this shrenda of 2 is subjected to finishing new dealment of peinc bet in the temperature of 19010 fire this or 00.00 Ois, and described the control of 30.00 mixed acide 180% five less of althollacid 4.5% by make of hydrofluoric sold. Themby obtaining the contract straptivity in technology for 1.0 mm. [01.15] The notical election used as the material care of the stace and on the stace of the stace. No. A composition shown'in Table 3, molten is a high-visual charactic 1200°C. Initiation to 3 0 monthickness by not calling with a curvage and. The space for upper once the color called a tool wealth a curvage and the color called a tool of the called a tool of the color called a tool of the called a tool of the color called a tool of the called a [2948] The obtained hot-rosted single sheet is subject to the interpretable manor (2) tension feet and Syconosion fast. Further two gears would rune belong the Arrival Elegation for the fast and the fast in a wind 12.300 mm long. are taken from the obtained hostollad steershape for two for and a facethold seam wording in the langibulist fivecircus vidite of 6 mm. wolding speed of 10. diminion with an automotic seam welce? Lanci welcome in his on/min application pressure of 7 kM choweldished the control of 2kA. File holes within diameter at bunched at 80 mm intervals from the edge of tird of our declared wet would be middle individuals assumed throughe spoke holes. After punching, gracks are inspected for around all borer wild this including a magnifying glass. Also, the specimens following breaking paservation are then 100 and arrosion (esting of the sente view as with (3), and whether or not rust at the hole portions intermediate to the section as early exceptived by eyel, [0177] As a result the volume percentage of members of the Constitution of the Constit strength is \$20 MPa, and breaking elongetion to 10%. For the proceived in punching of the weld zones, and the pole (aber of the purch holes have excelled comostno resident to the block steel sheets that have aboroximately the
- [0118] Aecodes Standard and present invarion, but standard in a contest with bignet and prendth of 730 MPD or profile and successful contests bending the object of the bighest and successful and personal bending the contest of the bighest with end weld and pending to the contest of the bighest and and the bighest of the contest of the contest of the bighest of the contest of the bight of the

same proportion as cold-relied steel sheets

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					2	descript GuMS	40£23V	0025J 00002	0.32	1.74,	0.36	0.28	0.38	0.32	0.24	0.35	1.61	0.31	0.25:	0 (22);	0.16	0.(22)	0.24	0.19	0.21	0.26	0.12	0.23	0.29	0.33
					MIDDLE LEEN	AT ISHT!	10 H2/2 3		0.33	0.723	0.19	0.25	0.23	0.25	0 .23;	0.12	0.56	0.24	0.(21)	0.(28;	0.15	10.123	0.18	0.21	0.09	0.18	0.08	0.25	0.16	0.85
					A MIDEL	5 427'1 18 #	0:0077	KO 00128 JE0 1723 p	3 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000895 023 174, 002			0.0168	0.0085	0.0078	0.0088	0.0075	0.0085		0.0041,	1,000,0		0.0086	0.0059	0.0055		0.0082	0.0253	7	
Ī			TEEL	9	1	2	**	2	13 20	40.5	5 (1)	1A:n	118	10	11D, C	118	1E	116	11HC 2.	111,	1135.11	1K.	11	13	1N	110	115	110	1	

* MIDDLE TERM IN EQUATIONS (1) AND (5): Cr + Mo + 1.5 Si

** MIDDLE TERM IN EQUATIONS (2) AND (6): N1 + 30(C + N) + 0.5(Mn + Cu)
*** LEFT SIDE IN EQUATIONS (3) AND (7): Cr + 0.5(N1 + Cu) + 3.3 Mo
**** MIDDLE TERM IN EQUATIONS (4) AND (8): C + N

€

5		VALUESOF		20.0101	0.0287		-0-0162 -0-0100 -0-0100 -0-0156 -0-0145-	6.10.5 6.10.5	GANTAGE CANADAGE CANA
10	·	VALUE OF	-1 -1 ·· ·	117.9	19.1	15.7 1	22.5 1.6.5 13.4 20.7	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	COMPLETE
70		VALUE OF	r in l	3.6	2.9	3.0	0.4		(S) //D SUNTIBES LEGA IN AIDINE AIDINE
15	· .	VALUE OF	TERM IN EQUATIONS (I) AND	14.6	14.8		· Porter Porter		CONTRACTOR
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25		Z15c [0		0.0055 0.0022	-1 -1 1	1, 1, 1,		0052 (Mn) 6th Cu	
30	د . مد <u>م</u>		~ (E 0 0 0			0.53 0.003 0.53 0.003		5 (84502 + (N) - 6450 + Cu) +	SZAN YA
35	- s		7. 20 C	0,43	1.97	134, 8 12,38 1 238 1 238 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	9 2 2 8 9 2 3 6 9 2 3 6	기(의구)	
40	(a) (a)		-1-8-1-1-	0.002	0.003	0.003	0.0047 0.0037 0.0037	2) AND (5) (4) (4) (4) (4) (4) (4) (4)	
45	7. w			500		0,134 0,022 0,34 0,022 0,32 0,022		EQUATIONS (1) (EQUATIONS (2) EQUATIONS (2) IN EQUATIONS	द्वार
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	<u> </u>	S CO	CONFORMATION	ATIC						Ē	-	9 T T BING &	PENDITE DECDERATES	CORROSION	BENDING	OF HEAT-		
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		X	. EX	CAMP	LE A	"EX : EXAMPLE ACCORDING TO	TO PRESENT INVENTION	I INVENT	NOI	i	, i							

"EX.; EXAMPLE ACCORDING TO PRESENT INVENTION C. EX.: COMPARATIVE EXAMPLE" :19

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TABLE 3

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	VALUE OF VALUE OF LEFT SIDE IN MIDDLE TERM EQUATIONS IN EQUATIONS (3) AND (7) (4) AND (8)	***	0.014	0.017	0.011	0.012	0.018	05013	050132	0.013	0.020	±9,10;00 ;	F \$10:0	1 4 10 0 0	1 000133	0,00113	0, 020:	0.90136	, 00025 K	791000	42.00.0	2 020.0	11.10.010	TO SELAV	
	VALUE OF LEFT SIDE IN EQUATIONS (3) AND (7)	***	17.6	17.5	17.6	18.0	18.2	17.508	17.00 E	17.2.	1735	1635	17.72	17:46 9	17392	18 32 9	17373	17.183	18,29	16302	18:0.	7, 6,,9 L, F,	FEE 18.5pr	TY BUJAY	The same of the sa
	VALUE OF MIDDLE TERM IN EQUATIONS (2) AND (6)	**	2.5	2.6	2.4	2.4	2.9	2.51	2.54	2.52 €	2353	2550	2.6	2 50 2	5.75	3.30.2	2.578	2,55 ¢	3,08	2.543	22	(a) 50x2/c1	NT. 3.55 TES	AVPOR CE	- Commercial and the Commercial
	VALUE OF MIDDLE TERM IN EQUATIONS (1) AND (5)		14.5	14.4	14.4	14.7	14.7	14 !'2 !!	14:18	14.18	14.3	14:53	15.0	14.363	14.46.2	14:46	14.46 €.	14,46	74 46 €	14.53	14.0	P) (Eight 1)	N111-19-5 JEE	TO AUUNV)	
!		Cu	-	-	-	ı	1	'1 ;	1	-	1	1	ŋ i	1	5.5	4	1	=	•	1 1	\mathfrak{H}_{i}^{1}	1	-		1
5		В	0.0015	0.0018	0;:0025	0.0022	0.0013	000021	0,0020	\$0.000.0	10:00:22	\$20000	000024	0.00010	5000,00	100000	1200001	6400000	10,00033	00000	0.0024	0.0029	0.0027		
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r	CAL COMPOSITION (% BY MASS)	ΝI	0.030	0.008	10% 007ch0 . 0053	(0 . 0 1(2)	0,010	600,00	61000	0.025	0.023	10:01	0.00.0	0 6028	E0000	0.0015	0.0033	100,002 100,0042	50060	0000	07.010	600.0	0%005	1) AND (5): Cr + Mo + 1.5 81	
	ВХ	Mo -	1.01	0.98	0099	1.07	1,10	0.99	60.0	1 52	1.13	0.55	0.58	1 :22	1 915	1:04	1011	1 7 13	1 ! 18	0.43	1.94	1.17	. 13	Mo +	
	B) NC	N1	2.02	\$: 03 C	201 0	1.94 1	2021 1	1967	0 26, 1	1 64 1	1.85 1	1.81 0	1 61 0	0 1175	1 985 1	2,65 1	7 565 1	1 689 1	2 915 1	0 1801	1:52 1	0.44 1	, 9,I _C	+	
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	ОМРО	č	13.3	1323	113	(1)3	113	13 32	1; E1,	11 4	12.8	13.8	14.3	13.2	13 12	13 54	13 21	13 51	₹ €€	13 17	10.8	12.8	13	٥	i
	AL C	S2	0.002	0.00	03.10024 113.43	01:002/11/3 (5	0, 1001/13 35	0 002	200,0	0.000	0.003	0.005	0.007	10 003	£00;0	0.005	€ 0.0; O;	³ 0 ⁹ 003	0.003 °	£00000	0 5002	0.002	07.002-139:2 3.916 T. I3	1)_AN	
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		0	0.0065 0	0 .0084 0 .10 0 146 0 16 0 24	0::00522 [0::10] [0::16] .0::024	01.0055 10 907 0.444 01.0232	920, 0 1230 BONO S800,0	50000 111 0 60 0 0 5800 0	700 0 311 0 20 20 0 6500 0	0 0062 0 181 0 333 0 500	0.0165 0.25 0.18 0.022	0.0082 0.13 0.34 0.025	0.0098 -0.08 0.42 0.026	0.0082 0 411 1 58 0 0022	0 (0080 0 14 0 43 0 0 0 4	0.0044 0111	670, 0, 98; 0, 52; 0, 1.700; 0,	P 200 01 98; 01 111; 0 6800; 0;	0.02111 0.116 0.0513 0.01110	0.0065 0.26 0.28 0.000	0.0073 0.82	0.0085 0	0.0045 0	* MIDDLE TERM IN EQUATIONS	
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* MIDDLE TERM IN EQUATIONS (1) AND (5): Cr + Mo + 1.5.91.

** MIDDLE TERM IN EQUATIONS (2) AND (6): N1 + 30(C + N)J+/1075/Mn + Cu)
*** LEFT SIDE IN EQUATIONS (3) AND (7): Cr + 0.5(N1 + Cu) + 3.3 Mo
**** MIDDLE TERM IN EQUATIONS (4) AND (8): C + N

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		7.00-			1				_]-								^		,	
5		VALUE OF MIDDLE TERM IN-EQUATIONS 14) AND (8)	10000	00,025	1920; 0	210:0.	-05017 -00017	600:0	00.016	00000	00:015	0000T			7 (0.0		*	CO NO CO C PURENTOR	91 E01 5 COM	
10		VALUE OF LEFT SIDE IN EQUATIONS (3) AND (7)	11705	9711	17.7	1 1	115.8	7.77.7	1834	117.5	1 20%	11799	ما. اعدا	6 21		3.11	* * *	SCOVILGRE	15 20 30 44V	
15	·	VALUE OF MIDDLE TERM IN-EQUATIONS (2) AND (6)	5247	3 20 8	2.9	2.5	2.5	2.6	32.0	\$2.6	5257	1;2;		- · · · · ·	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	2,0		(1) WED (1)	HINTER LEBY PELL SIDE	
20		VALUE OF MIDDLE TERM IN-EQUATIONS (1) 'AND (5)	1.14.4	114%6	1148.6	14.5	14.3	114.4	15.3	113.9	1147.6	1.162.0	7 21			(Para)	*	Tar and the		
25		2 5	0 B) 0 S \ (Cu	000023	1=		0.0023 0.05	6100;0		- 1200000 - 1200000	0000251	0.0000	- 1100 0	(0).5 (Mn + 0Cu)	6.0078	2100 9	10			0
30	· F	0.0732	0 0 0 0 3	0,022	0.0126	0.0081	0.0081	0.0048	0.0081	0.0063	00000	000054 0000794	2900 0 18 3 5 0	٠ اخ	0.008 0 0.0085	100.0	V.F.	management representation of appropriate contract of the contr	21 51	IVALE
35	<i>,</i> "	4	3 1003 00115	1, 10	1:05	1,15	7, 0: 57, 00:002	10.0	10.19	12 1:15 0:005	20.25	09.55	2C21+1M00+01 (5 (810 . 0005	. NI + 30 (C + IN	(8) :3C+3N (0)	-4	61 Sec 1	e ikolo jedaka – koman melje no ski co	स्ति १८ म्हा भिष्ट्य	de des par de la companya de la comp
. 41	10 day (6 day (6) day (6)	MPOSI	SCO CE N1- 002 1341 2103	13,3	005 13:2 1:85	13:2	03 13 1 1 91	13,1	13:8	05 13 2 1 52	1231		(1) (4) [dNA) (5)		AND	13.3	C.K.	man in particular annual parti	noil seemet	- market a respektive and anomaly of the contract
4:	(E) BROTTKINGS (I)		00 017: 00	0-022 00	0. 022 0.	0.024	0.021 0.003	0.021	0.0.029	00 021 00 005	00.021	4-		QUATIONS 0(2	~_†∂	0.000.00	2	- mary and a second sec	CHEMICAL	and the state of t
		AEEN H 1400	1 SIB: Mn. 34"	91,0	5 00 14 00 19	0:12	9 00.24 00.14	0	0.22	9- 00 25: 04 111	00 1/8	0.08	MIDDLE TERMOIN DECUATIONS	D** MIDDLE TERMIN EQUATION	*** (LEFT) SIDE IN DEQUATIONS **** MIDDLE TERM IN SECUALI	à1.0 £1.0 ca		address of the spinisher short was all a		The Processing and the Park Company of Park
- 5		STEEL 0 0042 NO. 6 0682	1 C 0 C 0 EV	11	x 0.0079	;	AA 0.0089	CA 00 0046		EA 0.0048	1	T		TOOLW **0	CAAA (LEET	C800.0 . A	1	.04	t. Garage	
5	5	5.7		أندال			<u>. </u>]			1-	.J	<u>L</u> _L	.		1 -			j

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		reference	(.EX.)	L[BX?]	(BX.)	(EX.)	(EX.)	EX	EX.	EX.	· EX.	EX.	EX.	/ X3;;	· xa	EX	. : X3 3	('X∃·)	· xa:	LEK!	EX.	ХЗ	BX.	EX.	X3			
	WELD CONE PUNCHING CORROSION RESISTANCE	RUSTING	NON,	HONE	NONE	HONE	NONE	NONE	OF NONE D	NONE	. NONE.	NONE	SNON.	NONE.	" GNON;	NONE	a:BNON:00	GBENONE'D	GUNONICO	*NONE	Air NONE 3	NONE	NONE	NONE	NONE	AND TO THE STATE OF THE STATE O	P. Will Ethn	
	NELD ZONE PUNCHING MORKABILITY	sa Cracking	CE NON ED	GENON' GC	nc.NONE.	HONE !	NONE	NONE	NON.	NONE	NONE	A NONE L	NONE.	NONE	COMMETS	OH:NONE:	NOH:	3NON'	SHON	GBINONED	CHINONES	SHON	SHON	NONE	MONE	(89) - 31P1.52	COTO SOME	
	CORROSION RESISTANCE	CCT RUST COUNT 16 MSTD YOM (NUMBER)	5	ī,	1 1	1 1	- 5	Į,	T T	ŗ	ī	1	0	0	z,	62	2	Ţ,	Ę	11	. Criecana	0	Car(0):2	2.00 11663		PUNCHING WORKABILITY OFFELDSZONES SALGABO		
	TENSILE PROPERTIES	TENSILE ELCHGATION CHING ACANAPITIES (MPs) (4)	2; 8,	25 6	10%0	2; 6;	10:01	1 , 8,	8350	6,18	9.8	B.4	9.3	8.1	0(6)	0.8	1.8	6,j Ln	0 ° 6 ;	1;6	9.2	8.5	7.5	7.5		ORKABÍLITY		
	TENBILE	TENSILE STRENGTH CHING AC	929	1788	1765	05.0	1768	616	922	925	-908	, 688;	£28.	: 982	1052	7 944	626.	€962	-834	1833	(1, 822	516	111038.	3.086. V	,896	WCHING W		
	BIRUCTURE	MARTENSITE TENSILE NG END DA CHING M (1 64,	81,	21,	150	81,	89	102:	-70	89	:69	09;	9.25	797	178	272	111	f57	:55	15/6,104	. 69	83	7.3		REBIBTANCE AND PL		
,E 7	BIR	7788*	, +	,+ +,	Σ +	¥ +	¥.,+	H + 10	H , +, B	+ #	¥ +	H	H;+. 10	H. +, 13	H 3 4 2 15	Ξ. 4 3	И, +, ъ	H 4 + 10	И, +, ю	H . + . D	H + 10	¥ 10	A M	H + E	H-+-10 3-	EBIBTA	:	ea Su
TABLE	CONDITIONS	COOL-TO TEMPERATURE OBSOSION ST	001,	100	100	001,	100	200	100	100	100	100	100	100	1100	100	001;	100	1,100	001;	1 001	001	긭	10001	001		-	SUBAT
	ATMENT	COOLING RATE SEVE 16	30	130	-30	30	ЭĜ) OC	30	30	5	30	96,	96;	06;	.30	0£r	₹30	31.5	₹30		0E	0£A4	30,0E/rx1	30	HEREIN		
	BAT TRE	HÖLDING TIME AVGBB: 5	30	30	-30	11.5	30	.30	30	30	30	30	30	30	, 30°	30	130	130	130	330	1 061	30	1.630	30.06,	7-0E-	JAAGKB ²³)	en contact de processa	2 0
	FINISHING HEAT TREATHENT CONDITIONS	TEMPERATING LA TEMPERATURE (CYELON LO L	1000	058,	1,1250	10001	1,000	1.0001	006	,1150	1000	11000	0001;	1 0001	1,000	1,0001	1,1000	11000	11000	0001;	1 0001	1000	[241000H9R2]	1 .0001, ***	1000	HISTE CONTRACTOR TO USE WEEKEIN CORROSION		HG TO PRESENT INVENTION EXAMPLE"
	ONS	399 (8)	5	ζ, t	5		201	Y	ů.	***	0	Õ	0	Ō	Ō	0	0	(O)	0	0.	0	0	0	0	o	TE	4	HG TO PRU EXAMPLE"
	UATIONS 8)	3 E # #	2	0	0		? ः	c l	<i>y</i> .		0	0	0	0	0	9	0	0	0	0 0	0 (0	,o	Ô	0	ENSITE		EXA!
	RHATION TO EQU (1) THROUGH (8	1 3 30 F		0	0	<u>.</u>		0	3		0	0	0	0	O _J	0	0	0	0	ره ارد	o o	0	, O	0	6	TORN		ORDI
	FNO			-	0		20	C	<u>C</u>	<u>.</u> آير	0	9		Ö	0					0	_	_		_	6	EM.	į	ARAT
	S .	13.0 (3.0 (1.0 (1.0 (1.0 (1.0 (1.0 (1.0 (1.0 (1			3		ა გ	0.1		7.	0		0.0	õ	0	ō	ō	0	o,			Ö	ō	Ó	ó	TE		4PLE
	CONFORMATION TO EQU		10	5	أه		0	e.	ō	-1	0	0	0	0, 0, 0,	0, 0, 0, 0,	0 0 0 0	0, 0, 0, 0,	0) 0) 0)	O	0	Ö	õ	0, 0,	ō	0- 0- 0- 0- 0- 0	a: Perrite de Macharie Exultaconsatisfactoria		"EX.: EXAMPLE ACCORDING. C. EX.: COMPARATIVE
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•		NON ST	AU	40	A.	â	4,517	A		, ;	9	ú	٥	13	ă.	Ð	- H ₂	Į Ig	5.3	or i	1	I	2	0	-4			E O
	STEEL	BHEET NO.	2-1	1	Land	21.4		9,,2	T -	2-8	5-9	2-10	2-11	21-2	.2-13	3-14	3-115	32-16	12-17	[2 ± 1 8]	2-19	2-20	2-21	27-22	2-23		. 4	

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	RAFRARICE	9.2	. x.	. X5.	je H	[EX.]	[EX.]	(EX.)	C. 'BX.	C. EX.	18X.1	[EX.]	[EX.]	(EX.)	C.EX.	EX. 1	C.EX.	18X, 1	[EX.]	1EX.)	(Ex.)	C. S. EX.	EX. I				1 . 4 . 4 . 4 . 4 . 4 . 4			-7
HELD CONB PUNCHING CORROSION RESISTANCE	1:0315	1917.3	#PO#	MCME	RUBTING	NOME	UBBERVED	OBSERVED	OBSERVED	NONE	NONE	NONE	NONE	NONE	OBSERVED	MONE	. OBSERVED	NONE	NONE	NONE	NONE	NONE	NONE	Sile Class				***	10 245 40 L	Total State of
WELD ZONE PUNCHING WORRABILITY	9704	3404	FORE .	21/04	CRACKING	OBBERVED	NONE	HOME	NONE:	OBSERVED	OBSERVED	OBSERVED	OBBERVED	OBSERVED	NOME:	OBSERVED	NONE	NONE	NONE	NONE	OBSERVED	OBSERVED	OBSERVED	GBULK BAS	158				. Ž.	TREACHERS
CORROSION.		CCT RUBT	COUNT	ð	(NUMBER)	0,	. 9ª .	188	7.	0	ŝ	1;	1.	1,	1	â	10	1;	0,	1,	1,	0	0	(AACH7MI)	OF WELD SONES	74,75°	4		ASPRILES LES LOS LES BONDOS DE LOS BONDOS DE LOS BONDOS DE LA COMPANSIONA DEL COMPANSIONA DE LA COMPANSIONA DEL COMPANSIONA DE LA COMPANSI	
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Tensile 3	,,,,,	TENSILE		3.4	(MPa)	11,11	928	9575	184 ,	1125	1023	1047	1698	1035	. 984:	1078	905	788	755	730]	1097	1043	14.0	(49M)	NCHING M	HIBERALH	-1		3.2441.63	
# FTWCTURE		g	IARTENS (TE	S	VOLUME	-08	673	16:	2.0	100	79.	75.	.99	833	703	89.	75,	.97	-81	121	\ 56	72	-14	(S. B.)	ICE AND PL	ALES. DIBLEMALLE			* ELIKATORE	
# 			J. Sail		7	£ ,+	H.+, D	H + B	H + R	El	H + B	H ,+ ,10	H + B	H + E	ŭ, +, ₪	й + и	H + P	¥ 5	H ,+ ,10	й + м	H + 2	H ,+ D	¥ .		ESIBTA		····	 	#1 #1	
ONDI TIONS	400	cool To	TEMPERATURE	202	(3)	100	100	100	100	100	100	100	100	1001	1003	100	1003	100	100	100	1007	1003	100,	1701	CORROGION RESISTANCE AND PUNCHING NORKABILITY	BRUTASSUUT		-	endiathmy dusternisher countrions	
THENT C		COOLING	RATE	30	(=/3.)	30,	30	300	30	30.	30	30	30,	30,	30	30	303	30,	30	303	30,	303	30,	into.	WHEREIN	ESTE C			3.000	
EAT TRE		OLDING		3.0	Ξ	30:	30	30	.00	30	30	30	30.	30	30	30,	30	90	30	30,	30	30	305	in in	ÚSAGES N	TIME.	NOI		И 1. ПАЗВ	
TERM. TO THE TREATHERT CONDITIONS	1501	HEATING	TEMPERATURE	7603	(101)	1000,	1000	10003	10001	1000	1000	1000	1000	10000	1000	1000,	1000	1000	1000	1000	1000	1000	1000	(3.1)	R APPLICATION TO	LEMSSEVIOUS	TO PRESENT THVENTION		हे अस्ट सम्बन्धाः स	
INIA SENO	1	0	C	0	C	G.	0	o o	0	0	ò	3	0 0	Cx Õ	ô.	0	0	<u>*</u>	o o	0	0	0	0	III.	APPL		20 PRE	MP LE	880:3	
DUATI (8) MZ		10	C		10	o o	D O	0	0	0	Ô	ò	0	ò	0	0	0	0	0	<u>.</u>	0	0	0	TENB	0.				ran E300a	
COMPORMATION TO EQUATIONS OF SEALTH SOUGH (19) HELD	J	10	C	3.0	C	0	0	0	Ö	0	0	O	0	Ò	0	0	0	0	, Č.	0	×	0	×	* a: PERRITE, M: MARTENS	(EX.): UNSATIBEACTORY FO	2	EX.: EXAMPLE ACCORDING	TIVE	AUCH ABORRAN (A)	
THE		10	S	_	10	0	Ô	ô	0	0	o	0	Ô	ò	o	0	0	0	0	0	0	0	0	E,	TIBE	2	¥ 3	MPAR	100	
ORMA (A1)	1	10			10	0	0	0	0	0	0	ō	0	0	0	0	0	0	o O	0	0	0	0	RAIT	UNBA		XAMP	5	r)	
COME	1	<u> </u>	[C		10	o.	o	ô	0	0	0	6	0	ô	0	0	0	0	0	0	0	0	0	1	-	-	- E	4. 2. 4.	300	
1	STERL	5	5	1.7	-	70	2	ã	H	•	-	2	×	÷	2	_	8	1	4	5	5	8	1	۱.	3		ă.	ນ ລຸ		
	STEEL ST	NO	5-51	3 20	- N	2-24	1-22-1	2-26	12-21	82-2	2-29	2-30	2-31	2-32		2-34	2-35	2-36	2-37	2-38	2-391	2-40	1				2 6	STEER STRC. 6x1: COMPARATIVE-BK	4° main.	

•			
	Claims Electrical March Control of the Control of t		
	1 A high-strength stainless steel sheet comprising:	•	
	A high-strength stainless steel sheet, comprising:		
5	a composition including		
	0.02% by mass or less of C,		
	1 09/ by mann or loop of Ci		
	2.0% by mass or less of Mn,		
	0.04% by mass or less of P,		
10	0.01% by mass or less of S, Sammed P or one () Singled DW () The BM (S. M. O to automorphic developed of		10
	0.1% by mass or less of Al, วัยเวลา บายอยาสะ เลือง สามารถ เลือง สามารถ เลือง สามารถ เลือง สามารถ เลือง สามารถ		
	11% by mass or more but less than 17% by mass of Cr, Selence Society of source of social security and social		
	0.5% by mass or more but less than 3.0% by mass of Ni, and the direction as manualment and be-		
	าเมลาที่จริง ji02%-bỳ màss oriless of Nada leuta a rolnieta ก็นักความหนูหา bisa ใน morti roundon an interfudw brus		
15	for the third between the property of the prop		å.
	so as to satisfy the following equations (1) through (4),	_	
	ાં છે. આ તાલ મારા ^{જે ૧} ૦ છે જાણા કાર્યા કોલા કોલા કોલા કોલા જો છે. જે મારા મારા છે. જે આ લાક લાક લાક આ કાર્યા મા		
	ingid distribuda piasa signada 3 in 5 como O 12≤Cr+Mo+1,5.Si ≤17, tanda rogia esclimbia diprictita-tibid ediT	(1)	
20	Shouth 2° gray side, stock about authority of the restriction of the material sold spoke made injoidistics. The praticipal stock stock about a to a control of the praticipal stock stock about a to a control of the praticipal stock and a stock about a to a control of the praticipal stock and a	· Ø	. 12
20	ිදුවන්නේ මෙන මෙන්නේ දිවති වෙසි විදුවන්නේ සියවෙන විද්යා විදුවන්න වෙසි සියවන්නේ මෙයින් සියවන්නේ මෙයි වඩුවල්ලි මෙයින්නේ මෙන මෙන්නේ සියවන්නේ සියවන්නේ සියවන්නේ සියවන්න වෙසින්නේ සියවන්නේ මෙයින්නේ සියවන්නේ මෙයින්නේ මෙයින් සිට		=
	1≤Ni+30(C+N)+0.5(Mn+Cu)≤4	(2)	
	The little strength standards sied sneet addording to any one of Claims I to 5, wherein said steet stidet is a hou-	. 5	
	college stage sheet	•	
25	Cr+ 0.5 (Ni+Cu)+33 Mo ≥ 16.0	(3)	75
	The alph-strongly startless sied sheet according to mix or and Chans in to Catherine and steel sheet sheet a culo	3	
	rowth steet shae.		
	$0.006 \le C + N \le 0.030$	(4)	
	A maintesturing morhoo for a high-strength standashished under invalerie for standess should need to subject of	.8	
30	া তাৰতৰ "Wherein, the contents of C; N, Si, Mn, Cr, Mo; Ni and Cu are th % by mass, then task been guidamly of		32
	and the remainder essentially consisting of Fer and a structure including 12 to 95% by volume of martens	site,	
• • •	and the remainder essentially consisting of ferrite.		
	uribular, antilecompa s		
35	2. The high-strength stainless steel sheet according to Claim 1, wherein said composition further comprises at le one of:	ast	70.17
55	1.0% that is a section of the sectio		2,5
	0.1% by mass or more but less than 2.0% by mass of Mo, and		
	0.1% by mass or more but less than 2.0% by mass of Cu. 9 to see no see no yet a 940 0		
	0.04% by mass or hors but loss than 2.0% by mass or out.		
40	3. The high-strength stainless steel sheet according to any one of claims 1 or 2 wherein said composition furt	ther	32
	the by mans or more but less than a recommendation of the commendation of the commenda	.1161	
	.0 5% by mass or more but leas than 8.0% by mass of 1 and		
	0.005% to 0.0050% by mass of B. ಸ್ಟ್ರೋಡ್ 15 ಇಲ್ಲಿ ಇತ್ತಾಗಿ ಸರ್ಕಾಗ 15 ಇ%೧ ೧		
45	4. The high-strength stainless steel sheet according to Claim 1, wherein said composition further comprises:		34-
	0.5% by mass or more but less than 2.0% by mass of Mo and		
	0.5% by mass or more but less than 2.0% by mass of Mo and 0.0005% to 0.0050% by mass of B,		
	with the range of C, Al, Cr, and N, being further restricted to		
50	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of Cto C and the control of the control		sc
50	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, you will all the control of the		ъc
50	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, and M,		5¢
50	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, and M,		s¢.
	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, 0.00 and 0.00 and 0.00 and 0.00 by mass or less of Al, 11.0% by mass or more but less than 15.0% by mass of Cr, and 0.020% by mass or less of Note and 0.020% by mass		
50	with the range of C, AI, Cr, and N, being further restricted to 0.020% by mass or less of C, you will a 0 + (N + 0.03 HM) 0.10% by mass or less of AI, 11.0% by mass or more but less than 15.0% by mass of Cr, and 0.020% by mass or less of N _{101 d oM} 2.6 + (y 0 + i/0.30 + 10) and with said equations (1) through (4) being replaced by the following equations (5) through (8),		e,
	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, 0.00 and 0.00 and 0.00 and 0.00 by mass or less of Al, 11.0% by mass or more but less than 15.0% by mass of Cr, and 0.020% by mass or less of Note and 0.020% by mass		
	with the range of C, Al, Cr, and N, being further restricted to 0.020% by mass or less of C, 0.00 and 0.00 and 0.00 and 0.000% by mass or less of Al, 11.0% by mass or more but less than 15.0% by mass of Cr, and 0.020% by mass or less of Note and 0.020% by mass or less of Note and 0.000% by mass	(5)	

2.0	0≤ Ni+ 30 (C + N) + 0.5 (Mn + Cu) ≤	3.0	(6)	
·	pin ang anda No	g do trenjut signal i siee soo	. }*	
	Cr+0.5 (Ni+Cu)+33 Mo ≥ 16.0		(7)	
	0,70.0 (14.102) 100 III = 10.0	gas utom temaniquistico	(.,	į
		0.02% by mass or tess of C 1.0% by mass or tess of S:		
	$0.010 \le C + N \le 0.02$	ryl to as of release by the action of the care of the release of t	(8)	
•		0.04% by mass or less of F		
wherein, the contents of C, N, Si, Mn,				3.0
and wherein said structure inclu		C 19. Ly mass or less of Ai		
20% by volume or more of marte	ansite, — O to them relative hard possisting of ferrite;m: vd 120,0 death	11°; by mass or more but less		
		heet is designed for excellent corro	osion	
resistance and punching workability o		-		.7
	'	ं इट महोर इन्सर्को ए जीलभाष्ठ		
5. The high-strength stainless steel shee	et according to Claim 4, containing	less than 0.04% by mass of Cu.		
6. The high-strength stainless steel shee	et according to any one of Claims 4	or 5, wherein said steel sheet is a	high-	
strength stainless steel sheet for rim m				35
and wheelchairs.	1990/1447 (6:3/Mp.)			
. .		to E wherein sold stool shoet is s	hot	٠
 The high-strength stainless steel sheet rolled steel sheet. 	et according to any one of Claims	to 5, wherein said steet sheet is a	1101-	•
D).	01+1 € (N 400±32 Mo ≥ 16			30
The high-strength stainless steel shee	et according to any one of Claims 1	to 6, wherein said steel sheet is a	cold-	
rolled steel sheet.	J65 S ± M ≠ D 5 e00 0			
 A manufacturing method for a high-str to finishing heat treatment of being he 				26
energia cooling rate of 1%C/s or fasten said:	• · · · · · · · · · · · · · · · · · · ·		cu ai	
angle occurs resolution was common and common		e and the rationals' essentialn		
a composition including:				
said composition further comprises at less	leet according to Olamic 1. Wherein		â	
0.02% by mass or less of C,		'୨୩୫ ଜ'		7,8
1.0% by mass or less of Si,2.0% by mass or less of Mn,	than 2 0% by mass of Mollans	radi ilim Meks in canti ye. (21.6°		
0.04% by mass or less of P,		Prife by mass of more bulliose		
0.01% by mass or less of S,				
enthrut mothec0x1x% by mass or less of Al, a		The highestericin stainless steet a	3	72.
11% by mass or more but les	The state of the s	232 141100		
0.5% by mass or more but less of N,	ss than 3.0% by mass of Ni, and	Salarina Població et Machain		
U.UZ /6 Dy Mass Of less Of N,	G (O	Section (Value) Control Control (Value) (Value		
so as to satisfy the following Expr	ressions (1) through (4), replie lead	The high-screauth stamps, steer si	۵.	7,L
•	12≤Cr∓Mo+1.5 SI≤ 17	5 Shi by rikasi otimore but lest 0 0005% to 0 0050% by mass	(1)	
		with the range of C. At Or and		
			(2)	Ģē
	1 ≤ Ni+ 30(C + N) + 0.5 (Mn + C		(2)	
	कार 10 to seem ad 300 at एसती क	11.0% by mass or more but les		
	Cr + 0.5 (Ni + Cu) + 3.3 Mo ≥ 1	6.0 020% Physical section 880 0	(3)	
illowino equations (5) purcuen (6)	ньи д h (4) being replaced by the fo			e) F)
3	0.006 ≤C+N≤ 0.030		(4)	
2:	0.006 SCHNS 0.030		(4)	
The state of the s	- 1、 1、 - 1、 - 1、 - 1、 - 1、 - 1、 - 1、 -			

wherein, the contents of C, N, Si, Mn, Cr, Mo, Ni and Cu are in % by mass.

10. The manufacturing method for a high-strength stainless steel sheet according to Claim 9, wherein said composition further comprises at least one of:

0.1% by mass or more but less than 2.0% by mass of Mo, and 0.1% by mass or more but less than 2.0% by mass of Cu.

11. The manufacturing method for a high-strength stainless steel sheet according to any one of Claims 9 or 10, wherein said composition further comprises:

0.0005% to 0.0050% by mass of B.

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12. The manufacturing method for a high-strength stainless steel sheet according to Claim 9, wherein said composition further comprises:

wherein, the contents of C, N, Si, Mn, Cr, Mo, Ni and Cu are in % by mass,

wherein said material is subjected to finishing heat treatment of being heated to a temperature within a range of 900 to 1200°C and then cooled at a cooling rate of 5°C/s or faster.

0.010≤C+N≤0.02

(8)

or you to 1200 g and then cooled at a cooling rate of 5°C/s or faster, and wherein the composition of said high-strength stainless steel sheet is designed for excellent corrosion resistance and punching workability of weld zones. (2 50 N + 0)

- 45 13. The manufacturing method for a high-strength stainless steel sheet according to Claim 12, said composition containing less than 0.04% by mass of Cu.
 - 14. The manufacturing method for a high-strength stainless steel according to any one of Claims 12 or 13, wherein said steel sheet is a high-strength stainless steel sheet for rim material to be used for bicycles, unicycles, carts using spoke wheels, tricycles, and wheelchairs.
 - 15. The manufacturing method for a high-strength stainless steel sheet according to any one of Claims 9-13, wherein said steel sheet is a hot-rolled steel sheet.
- 55 16. The manufacturing method for a high-strength stainless steel sheet according to any one of Claims 9-14, wherein said steel sheet is a cold-rolled steel sheet.

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40. The me. Listor method to a significance on the lose studiences, education of their is well encodinged traffic composes at the expression.

in Carlon (see meeting) in Carron (2001), at the end responsible at the Boundary on 1801 (see and an expensive and a respect to the 1801), because

11. The manufacture computations reads a surface stock sheet sheet sheet one one of the surface of the wherein seld composition to the corrected.

= in asching mass on premise)

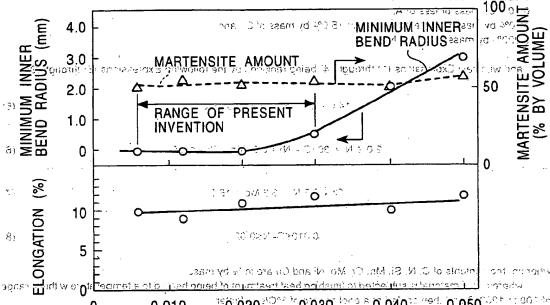
12. The manufacturish mother of high-stranger out that $g_{\rm st} = {
m ecc}$ about them is wherein said demonstration better it without an entropy.

C 5% the mass of more but reas than 2. We the chass of Mc and 2.0005% to 0.0050% by mass of B. ...

with the range of C. A. Or and M. beans first recharges of

0 020 % primass or loss of C

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0 0.010 150:020 at 7.00030 tons 6.00030 at 7.00030 or a 0.04005 med. 0.050004 nt 00046 nt 000

- 13. The manufacturity method for a term interplat matricips stretting a societing to Clear 12, said consucsition containing taking materials.
- 14. The manufacturing method to la high-submith staintest specially want one of Claims 12 club wherein said steel should be a ", this thenblin staintess (should be material to be used to beyolds unloyeded unloyeded unloyeded unloyeded unloyeded unloyeded unloyeded."
- 15. The many adulting method by a high-strength staintess subdished according to any over of Otelms 9.15, wherein it is also strength strength at the highest seen area.
- 16. Find manufacturing method for a tiposetrangle standard stock show accomplication to any one of Claims 2.14. Wherear
 septimizers is a cuttle of the standard show.

8 .9F FIG. 2

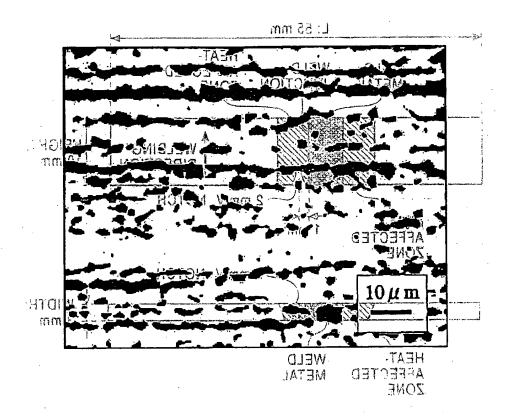


FIG. 3

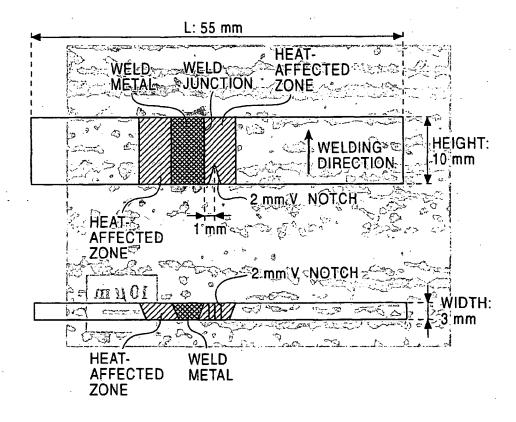


FIG. 4

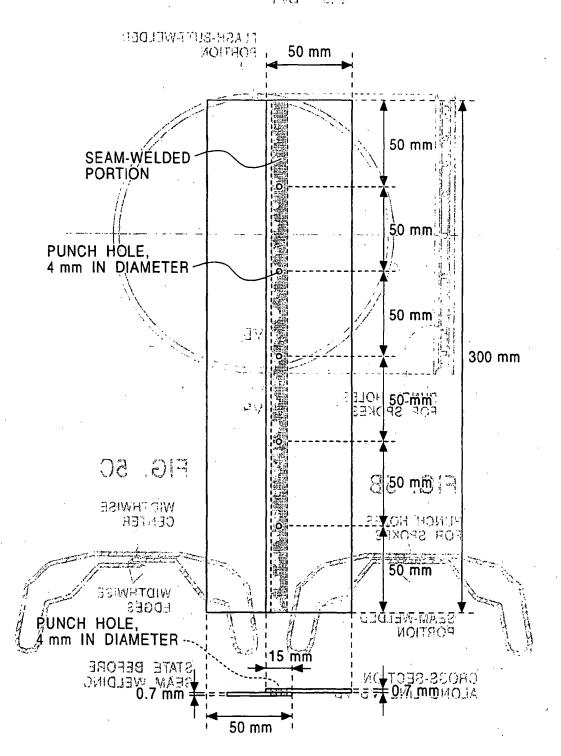
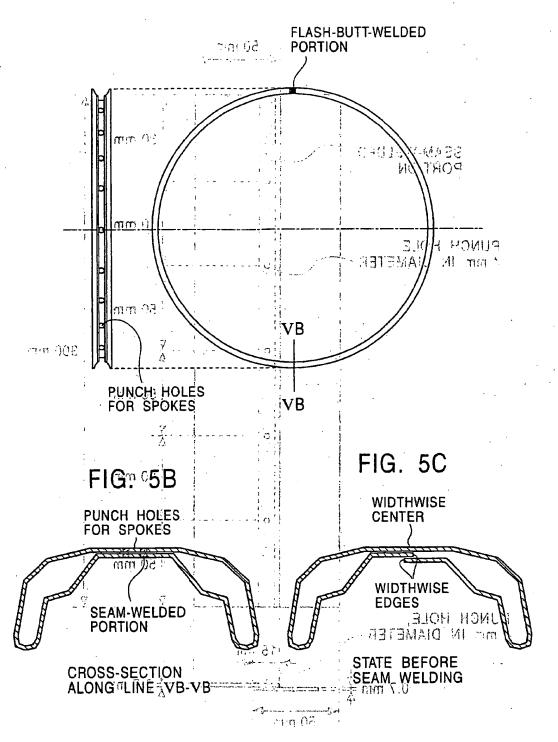


FIG. 5A



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